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Water-Works Number

Revamping Toledo Pumping Station Under Service

Railway Water Consumption and Waste Prevention

Results of Completely Metering Omaha Water Supply
By F. P. Larmon
Chief Engineer, Metropolitan Water District

Leaky Cross Connections Located by Alkali Test
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Articles on Filtration:

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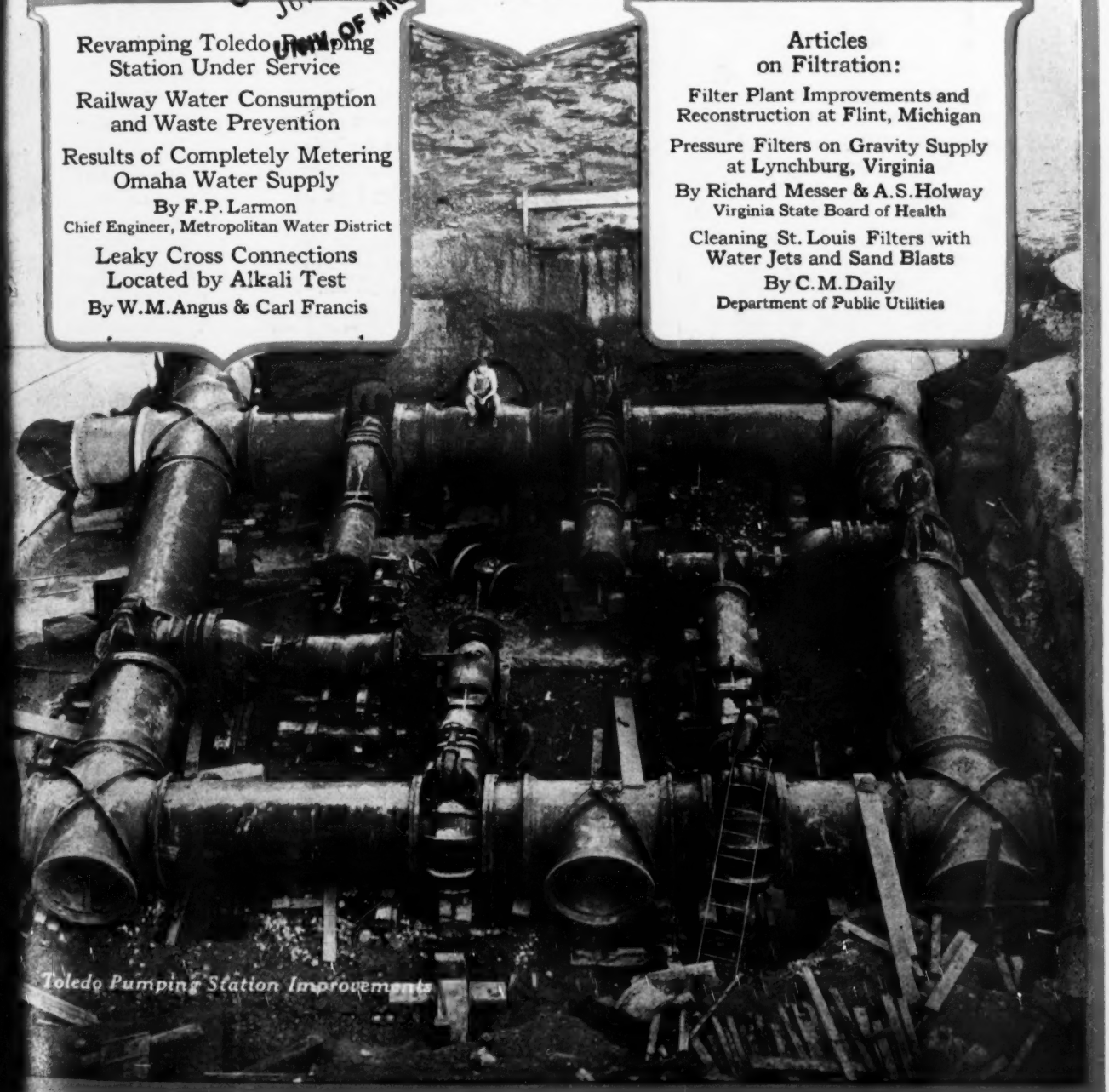
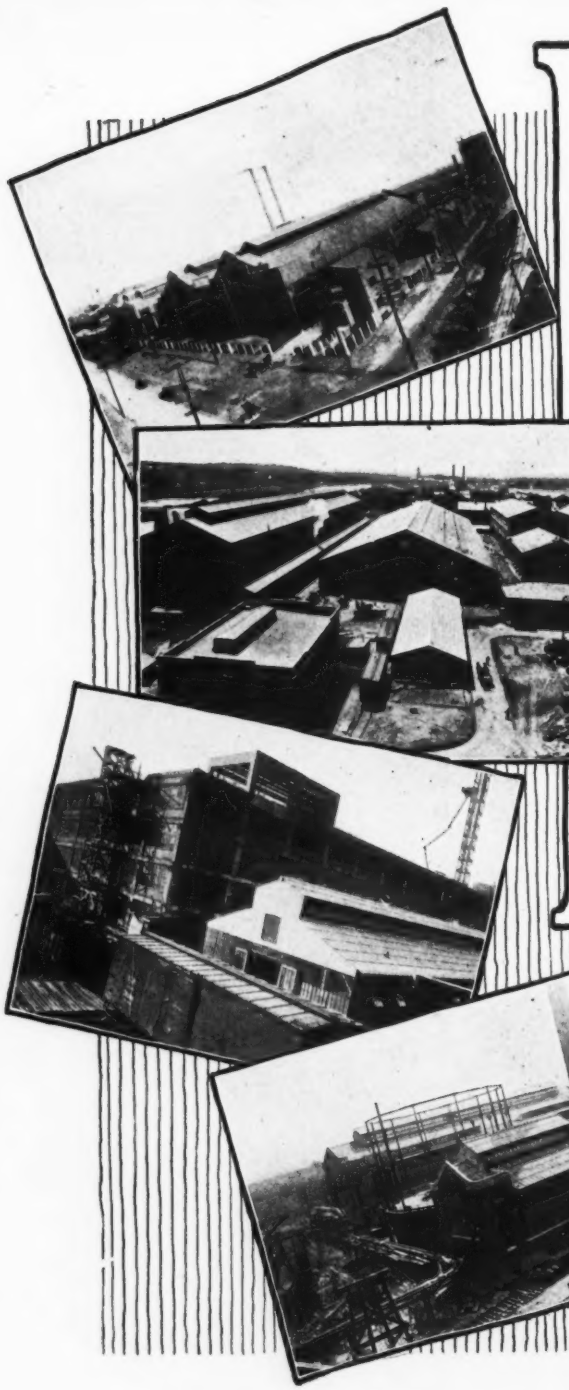
Pressure Filters on Gravity Supply at Lynchburg, Virginia
By Richard Messer & A. S. Holway
Virginia State Board of Health

Cleaning St. Louis Filters with Water Jets and Sand Blasts
By C. M. Daily
Department of Public Utilities



Toledo Pumping Station Improvements



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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. Mehren
Editor

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The Water-Works Convention

HUNDREDS of water-works men will gather at Montreal next week for the annual convention of the American Water-Works Association. In accordance with the time-honored custom we devote a large part of the issue preceding the convention to water-works subjects. Topically and geographically the articles have a wide range, as may be seen by the following comments suggested by several of the articles. This issue is by no means given up to water-works subjects and of the articles designed primarily for water-works men a goodly number will appeal to all who wish to keep abreast of engineering progress as a whole.

Arc Weld Aids Main Tapping

ONE of the greatest advances ever made in the field of water-works operation appliances was the use of tapping machines. They made it possible not only for service pipes but also for large branch lines to be connected with water mains under pressure, with no interruption of the water supply. An additional tapping facility, for use on the very thin shells of steel mains, is giving much satisfaction at Los Angeles, as described on p. 1212. This is a portable electric arc welding outfit for attaching a tapping shoulder to riveted mains so that the latter may be tapped as are cast-iron mains.

Pump-to-Pipe Connections

WATER-WORKS pump-to-force-main connections are often clumsy, due sometimes to piecemeal construction to meet increasing consumption. That courage in both design and capital outlay—extending, if need be, to the complete reconstruction at old stations—can substitute safety, convenience and economy for clumsiness, risk and unduly high operating expense, is shown by the description of the new header system at Toledo on p. 1184. The article shows anew that what *can* be cured *should not be* endured—even if one must contend against great odds through several political administrations.

Sandwasher Evolution

WHATEVER the efficiency and economy of the drifting-sand water filter may prove to be no one can deny the ingenuity that has been shown in its design. One of its most interesting features is the continuous sandwasher. Sceptical observers shook their heads at the thought of the heavy wear and tear of the moving sand on this device. Experience showed that this was a subject for concern. To let a promising engineering development be handicapped by a mere detail would be a sad reflection on engineers and engineering. The evolution of the sandwasher, with particular reference to avoiding metal erosion, is described on p. 1192. Loss-of-head data add to the interest and value of the article.

Adapting Old Tools to New Uses

IN THE utilization of a sand blast to clean out the holes in strainer plates of St. Louis filters, the filtration expert has successfully adapted to its uses one more tool from another industry. Picking open 102,000 strainer holes per filter by hand was a slow and tedious job shunned by all the men in the plant, says Mr. Daily (see p. 1198). Again, passing sand from one filter to another by a sand ejector is an old scheme, but obtaining a continuous circulation in one bed through one jet is new. The point in this case is the application of wash water through the underdrains, permitting the ejector to sink through the softened sand bed, thus making the feed of sand to the jet automatic without labor. The latter is a factor not to be overlooked in these days of "no common labor."

Building Up Filter Sand

THE experience of so many filter plants with increased sand size due to accretion when using lime and iron as coagulants brings up the question, Is it worth while to be so particular in specifying sand size? Why not pick a sand from a supply near home and then build it up chemically to the size required, thereafter alternating the kind of chemical used so as to maintain that size? Some operators do alternate the chemicals, but the task of building up a small size sand and then maintaining it has not been attempted.

Leaky Cross Connections

TESTIMONY as to the danger from leaky cross-connection between city and private water-supply systems continues to pile up. Following the article and editorial on the subject in this journal on May 13, a letter appeared in the issue of June 3, p. 1124, showing that the engineers of the National Board of Fire Underwriters are against such connections. Two further letters appear in the present issue and also an article on the use of the alkali test to locate a leaky cross-connection. Where such connections cannot be avoided two safety valves rather than one should be used and they should be frequently inspected.

Water Economy on Railways

WATER consumption by railways aggregates a volume and cost not generally realized. It occurs at so many places on a railway system that it is not easily kept under control. Within recent years the railways have come to appreciate the possible large savings that may be effected by systematically checking waste and improper use at the numerous and scattered water stations, shops, terminals and other points. This waste is particularly serious where water is scarce, requires treatment, is purchased or is unusually expensive for any cause. Particulars of consumption, waste and waste prevention recently compiled by railway men are given on p. 1202. The data indicate that

as the need of additional supply, better quality and more economical use of water have been recognized, there has been greater attention given to railway water departments, whose responsibilities formerly were limited and vague. A number of railways have established a comprehensive water organization which not only provides the supply and the facilities for its use, but has supervision of construction, equipment, treatment and maintenance of all water service. An organization of this kind can wage effectively a campaign for water-waste prevention at widely scattered points on a large railway system.

We Are Complimented

IT is not often that *Engineering News-Record* is read on the floors of Congress. When it is we take some measure of pride in it. With all due modesty, then, we note that in the speech by Representative Nelson, of Minnesota, as printed in the *Congressional Record*, there appears almost in its entirety our recent editorial on the St. Lawrence power and navigation scheme. That there is no mention of this journal or even a sign of quotation marks is doubtless an inadvertence. Or else Mr. Nelson is like the lyre-smiting 'Omer—"What 'e thought 'e might require, 'e went and took."

Municipal Housing

MUNICIPAL housing has been practiced abroad for decades and is now going ahead on a vastly increased scale. American housing conditions never were and probably never will be as bad as those of Europe, but our standards and the ability of our wage and salary earners to pay, are higher than those abroad. These reasons, together with the stoppage of dwelling construction at a time when almost everything unites to discourage building operations and when there is a strong tendency to ask for government aid, all combine to bring pressure upon our cities to follow overseas precedents and embark upon municipal housing. Abroad, engineers have had much to do with municipal housing schemes and if our cities are to build houses there is at least equal reason for the work being assigned largely to engineers here. How many of our engineers are ready for it?

Shippers and Higher Rates

SOME time ago we asked the question, "Do Shippers Want a Railroad Subsidy?" Since that time the attitude of organized shipping interests has apparently undergone so great a change as to have put an entirely new light on the matter. In testimony taken before the Interstate Commerce Commission last week, the chairman of the National Industrial Traffic League urged that action be taken to increase rates: "We are paying today indirectly for a lack of service more than we would be called upon to pay in rates sufficiently high to maintain an adequate service." When it is recalled that bodies of shippers in the past were organized largely for the avowed purpose of holding railroad rates down to a bare minimum, such comment as this, from shipping interests, is most significant. Willingness to pay higher rates for adequate service is being manifest by shippers everywhere. Now let the railroads meet them halfway with proof of their willingness to break away from some of the business-getting policies of the good old days.

Planning Ahead for Water Power

LOOKING ahead is becoming a most important feature of water-power development. Time was, not so long ago, when each hydro-electric scheme was sufficient unto itself and little thought was given to prospective increases in output which require additional storage and flow. Today the prospective linking up of drainage areas for greater storage and planning of future plants for connected power lines must be kept in mind in the original design. In both California and New England this foresight is being executed in definite fashion and storage basins are being prepared and plant sites located some time in advance of the real need for the power to be developed therefrom. Primarily, the study of drainage basins is undertaken to get the maximum total power out of a stream but other advantages come of comprehensive studies. Considering the power sites of a basin relatively often makes it possible to rearrange the general scheme so as to use additional storage capacities here and there or to plan diversions of storage and flow so greater peak loads of short duration can be carried. A definite program for a term of years reduces the development cost because the company can then afford to gather and maintain a high class construction organization of its own, with which the work may be done for less than by contract. Moreover, a definite schedule makes it possible to allot to each year the desirable expenditures for that season and these figures for a term of years ahead greatly facilitates the financing which the company will have to do. The foreknowledge of what power increases may be expected enables the commercial department to plan its schedules more intelligently; business of a certain character can be sought for at the right time and effort is not wasted on other business which would exceed the profitable maximum. Commercial considerations, therefore, link up with technical ones.

Prompt Action Needed on Engineering Society Federation

THE story of the Organizing Conference at Washington early this month was told in last week's issue of this journal. The meeting having developed a plan whereby a federation of engineering societies can be created, the next step must be taken by the individual bodies whose delegates were present if the federation is to develop into something more than a paper organization. The observer at the conference could not fail to note among the delegates a spirit of determination to bring about unity of action in public affairs and in matters of civic and economic importance, insofar as engineers are concerned with them. The individual will to do is present and must be backed up by group action. Delay now may wreck the federation plan at the very time it is ready to go forward. It is the duty of the societies, therefore, to put the question before their memberships and to obtain, not general discussion, but a *decision*.

The American Society of Mechanical Engineers, as noted in an editorial last week, is definitely committed to the federation plan. Reasonable assurance also has been given of the entry of the American Institute of Electrical Engineers into the new body. Up to the time of writing, however, no word has been received from the local engineering societies. It is vital, if the

federation is to be truly representative of the whole country's engineering interests, that the local organizations be adequately represented and take just as active a part in the federation as the larger national engineering units. In fact, it is upon the locals that the Federated American Engineering Societies will depend in great measure for strength. At the Organizing Conference opportunity was given for a full and free discussion of the subject. Questions touching all phases of the new body were asked and answered. The leading technical journals in all fields of engineering carried a full account of the meeting and published, either in whole or in abstract, the constitution and by-laws endorsed. There is no excuse, therefore, for failure to reach a decision on the ground of ignorance of the objects of the federation, its organization and the general scope of its proposed activities.

If the voice of the engineering profession is to be heard—and the importance of its message both to the country at large and to engineers individually was emphasized by practically every speaker at the recent Washington meeting—engineering societies, national, state, regional and local—must get behind the federation and give it their unqualified support. Before the new organization great opportunities lie. They will not be realized if a mere handful of societies accept the plan recently proposed. By united action only is the full measure of success for the federation plan to be realized.

Safety Administration at the Frontier

RECENTLY an important undertaking in bridge reconstruction was carried out at Niagara Falls. One of the two great railway structures crossing the gorge of the Rapids was rebuilt, as described recently in a paper before the American Society of Civil Engineers. A striking feature of the work, not mentioned in that paper however, was the fact that the Canadian railway authorities took cognizance of the work, while no United States authority concerned itself with it. There was an evident intention on the part of the former to see that the interest of the Canadian traveling public was protected, whereas no one made the public interest of our country his business.

Under our existing administrative systems, supervision over matters affecting the safety of travel is exercised by railroad and utility commissions, including those of the individual states and the Interstate Commerce Commission. But the Interstate Commerce Commission limits its safety functions very closely to questions arising from accidents, and takes no general jurisdiction over safety; it deals with the subject as to the facts only. State utility commissions, on the other hand, are commonly so fearful of invading the field of interstate commerce that they confine themselves to matters lying wholly within the state. Whether or not these be the controlling reasons, both the Public Service Commission of New York State and the Interstate Commerce Commission, answering our inquiries about safety jurisdiction over bridges crossing the Niagara frontier, have specifically disclaimed jurisdiction. They referred to two other bodies, the War Department, which through its Engineer Corps has Congressional authority over navigable streams, and the International Joint Waterways Commission. But upon inquiry it appears that these two bodies also are not interested. The Waterways Commission, which has broad powers over international streams, does not concern itself with the safety of bridges crossing them, and the War Department's interest is confined to navigation and this of course only in case of navigable streams.

Public interest in bridge safety is a matter of development. Time was when the safety of a bridge was no one's concern but the owner's. Today, many states maintain a current inspection of railway and trolley bridges, and it can truthfully be said that they do excellent service to the public by this work. The cooperation of railway and public representatives accomplishes more than one alone could achieve. And most obviously in the case of a bridge owned by one party and used by the trains of railways which lease the bridge, is there opportunity for conditions to occur that are unsatisfactory from the standpoint of public safety. These remarks do not of course apply to the Niagara railway arch, for a most excellent record was made there, in point of maintenance as well as procedure of reconstruction; the bridge is today stronger and better than when it was first completed. But there are other bridges over the Niagara as well as over other international waters, and it is a fair question to ask whether public safety supervision should not be so administered as to include bridges at a boundary.

Frontier questions constitute a decided puzzle in this field, as has been experienced previously in the case of bridges crossing from one state to another within the United States. There are instances in which interstate bridges have been regarded by public service authorities as being within the jurisdiction of neither state. In other cases, the authorities of one state took the common-sense view that the part of an interstate bridge within their own state is not likely to be safe unless the whole bridge is safe, and accordingly they treat the entire structure as if it were in their state. This simple expedient cuts a legal knot that either exists or may easily be imagined to exist.

So in the case of the Niagara Gorge bridges, for example, it is readily seen that the half of a bridge lying within New York State is safe only if the whole span is safe, and the same for the Canadian portion. Possibly the Canadian railway authorities acted on this view. But it is certain that those of New York State did not.

It should not be difficult to find means for bridging the jurisdictional gap existing at frontiers, provided there is an earnest desire to guard the public safety, and not merely a purpose to carry out the letter of a law. The existing situation is anomalous. It would still be so in a measure if the Interstate Commerce Commission took jurisdiction over common-carrier safety at frontier points, since this would still leave electric-railway bridges unsupervised. State public utility commissions, however, in most instances have functions broad enough to cover both railway and electric railway matters. Thus the question could most quickly be disposed of by proper interpretation of the powers of state authorities. So long as such powers are interpreted in a narrow, literal sense, which demands that the whole of a bridge be within the state in order to bring it within the jurisdiction of the utility commission, public safety administration will be interrupted at frontier points in an unexpected and undesirable way.

Revamping Toledo Pumping Station Under Service

Piecemeal Construction Carried On Ten Years Under Four Administrations—Six Hydraulically-Operated Valves Manipulated from Table in Pumping Station Control Central Header System

By George N. Schoonmaker
Assistant Commissioner of Water, Toledo, Ohio

FOLLOWING the introduction of filtered water into the mains of Toledo, Ohio, in 1910, the consumption rose so rapidly that a substantial increase in high-lift pumping capacity was needed. How the reconstruction and rehabilitation of an uneconomical obsolete pumping plant was accomplished a little at a time during ten years because of lack of funds and authority and through succeeding political administrations is a typical instance of handicaps frequently met with in growing cities that can ill afford the inconvenience of a water shortage.

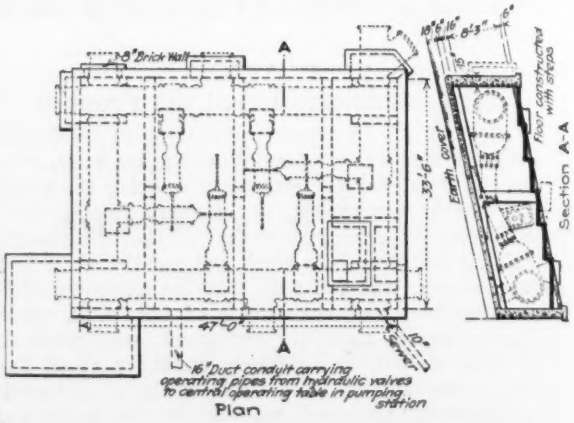
Incidental to the revamping of the station was the construction of a central header system of 48-in. pipe for collecting, controlling and distributing all of the water furnished to the city. This rectangular header system, with its five inlets and five outlets, hydraulically controlled by six valves, is a novel arrangement the advantages of which are made plain by the accompanying illustrations.

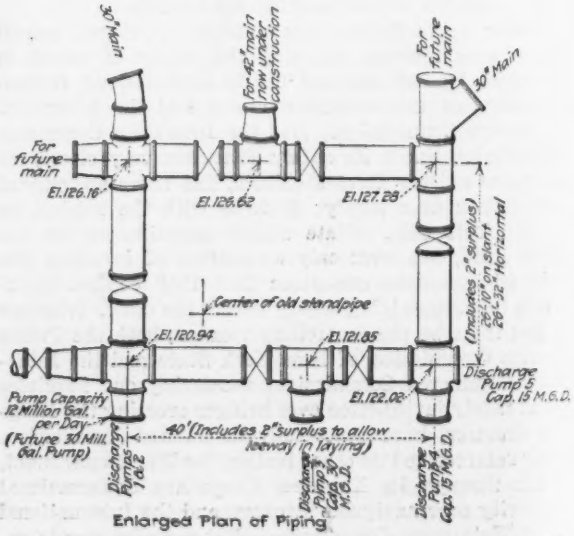
The pumping equipment at the beginning of the period noted was not only inadequate to meet the suddenly increased demands but was also obsolete and uneconomical, both as to engines and boilers. Pumps installed in 1873 were still in daily service. The pumping station was too small to house modern engines. A recommendation was made to the city council by the superintendent of the water department for authority to build a new pumping station, equip it with modern machinery and boilers and abandon the old station. This recommendation was not approved and the department had to rebuild and enlarge the old station and equip it piecemeal with new boilers and pumping machinery.

The first portion of the work, completed in 1913, was the installation of a 30,000,000-gal. triple expansion crank-and-fly-wheel pumping engine in the central section of the pump room, enlarged to accommodate it. Subsequently the remainder of the new building was erected around the old structure and the old building was then torn down. New boilers, coal-handling equipment, a 225-ft. chimney, an electric crane, electrical generators and a 30,000,000-gal. centrifugal pump with steam turbine were installed while keeping the old station and its equipment in continuous operation. The war and the necessity for doing this work in small sections greatly delayed construction so that the station was not completed until early in 1920, after a 10-year period of almost continuous tearing down and rebuilding.

Besides replacing antiquated machinery the department had to provide more ample force mains. Included in the original layout of water piping at the station was a 60-in. steel standpipe, 228 ft. high, inclosed in a masonry structure, that served only as a surge tank. As it was within 100 ft. of the old pumping station it was a source of possible disaster. The old discharge mains were so inadequate in size and so ineffectively controlled as to require complete revision. A new and well designed system of discharge mains was needed, but the old standpipe stood in the path of any new system of adequate capacity. This old structure was considered by station employes and residents as necessary to the operation of the station. Serious objection was raised to its removal, for sentimental and operating reasons. Without the knowledge of even the station employes the standpipe was closed off and drained and the pumping station was operated for two years by direct pumping to prove to both the employees and the public that no necessity existed for the standpipe. In 1916 the standpipe was razed and work was commenced on the construction of new force mains and the central header system. The work was interrupted by the war and the header system was not put into service until 1919.

The header system is in a concrete underground structure covered with a concrete slab roof. It is built


Brick Wall
Earth cover
Floor constructed with steps
Section A-A
47'-0"
16" Duct conduit carrying operating pipes from hydraulic valves to central operating table in pumping station
Plan


For future main
For 42" main now under construction
For future main
30" Main
El. 126.16
El. 126.62
El. 127.28
Center of old standpipe
El. 120.94
El. 121.85
El. 122.02
Pump Capacity 12 Million Gal. per Day (Future 30 Mill. Gal. Pump)
40' (Includes 2" surplus to allow leeway in laying)
Discharge Pump 5 Cap. 15 M.G.D.
Enlarged Plan of Piping

CENTRAL HEADER SYSTEM FOR BROADWAY PUMPING STATION, TOLEDO WATER-WORKS

up of 48-in. cast-iron pipe, special castings and six 48-in. hydraulically operated gate valves which are so placed that by shutting off two valves any line leading from the header to the city or from the station to the header can be closed off without interrupting the flow of water from or to the header through the other lines. The valve control is manipulated from a special operating table of the type ordinarily used in filter plants. This table, which is located in the main pumping station building, is fitted with three-way cocks and is provided with an indicating dial attachment for each 48-in. valve. Water pressure for operating the valves is obtained both from the force mains and from an auxiliary connection to the boiler feed pump system in the station.

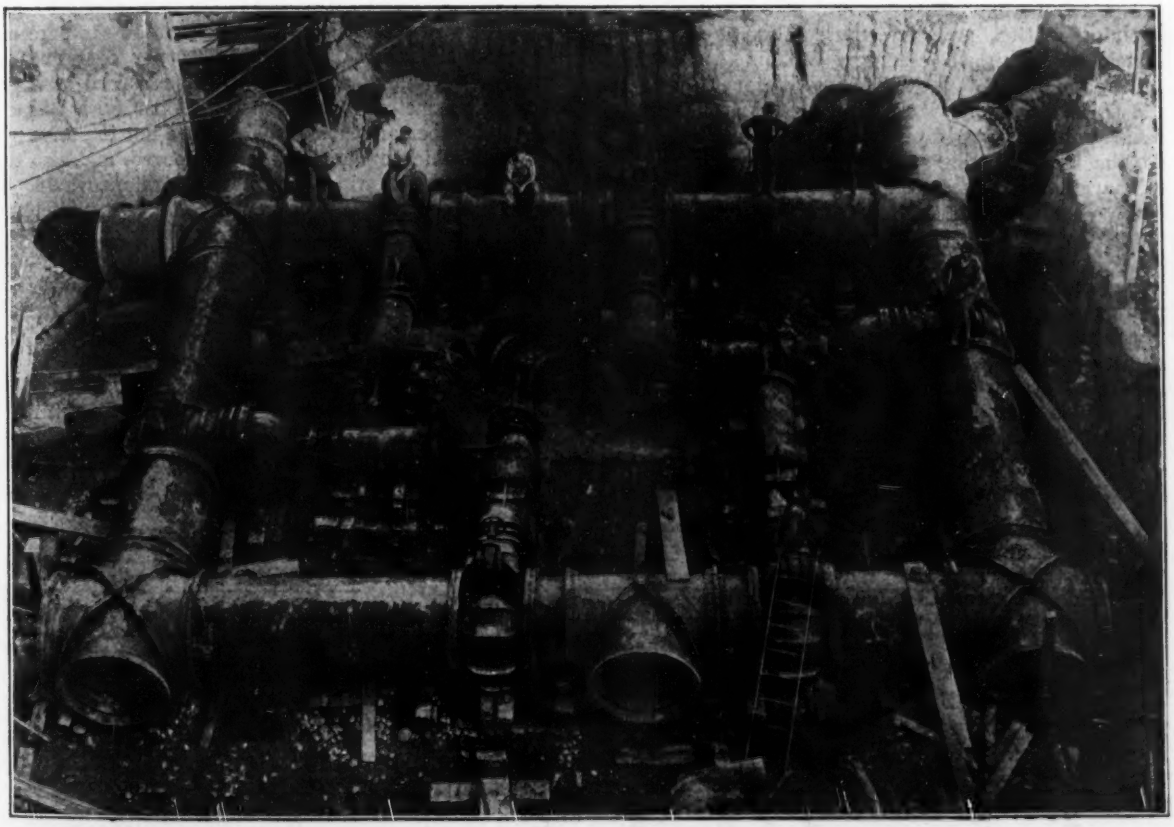
The piping and valves are placed upon the lower courses of masonry formerly supporting the standpipe and are blocked up on concrete piers so that all parts are accessible. The bell-and-spigot joints are poured full depth with lead and calked inside and out. The six valves have flanged connections to the pipe system. After the header system had been tested to 150 lb. per square inch and the joints recalked where necessary and the header retested, a concrete floor was poured and the walls and roof constructed.

The entire work of installing and constructing this header system was done by the employees of the water department using a 40-ton stiff-leg derrick with an 80-ft. boom. In order to align the header connections with the pump discharge of the force mains leading to the city, it was necessary to tilt the whole system of piping; the discharge side taking one angle from the horizontal and the entrance side taking an angle directly opposite. With castings of the sizes used this work was difficult but was accomplished with precision and all discharge and entrance connections were made to meet the exact elevations of the old piping.

It is believed that this header system is as flexible and as fool-proof as can be found oridinarily in connection with modern pumping stations, and certainly it is a distinct improvement over the relics of old pumping station discharge systems, as usually modified and augmented to meet the needs of a growing waterworks. The capacity of the header system is calculated at 120,000,000 gal. daily with a present maximum momentary peak demand of 52,000,000 gal. and an average daily consumption of 25,000,000 gal.

The original pumping station capacity in 1910 was 46,000,000 gal. per day, with a boiler capacity of 2,000 boiler horsepwoer which has been increased to 110,000,000 gal. and 2,800 hp., with space provided for an additional pumping capacity of 19,000,000 gal., making a total projected station capacity of 120,000,000 gal. per day. This will adequately supply an average daily consumption of 60,000,000 gal. for a population of a little less than 600,000.

Aside from the somewhat unique feature of the header system it is of interest to note that a municipal project designed and planned ten years ago has been actually carried to completion, following closely the original design, through four distinct city administrations. The writer does not recommend the methods



SIX 48-IN. VALVES CENTRALLY CONTROLLED OPERATE TOLEDO PUMPING STATION HEADER SYSTEM
Pumps discharge into five connections in foreground. The outlet at the top and left and one in center of cross-connection

STIFF-LEG DERRICK PLACED SPECIALS IN HEADER

adopted by Toledo in the reconstruction and rehabilitation of an obsolete pumping station, but this brief summary indicates what has been accomplished in municipal work through succeeding political changes, in the face of a refusal by the legislative body of the city to provide funds and authority for the construction of a new pumping station.

The rebuilding, enlarging and re-equipping of the pumping station, and the construction of the header system, was designed jointly by William G. Clark, consulting engineer for the Toledo Water Department, and D. H. Goodwillie, then superintendent of the water department and now director of public service of Toledo, the writer having served as construction engineer in charge of the execution of these improvements.

Higher Rates for British Consultants

The council of the British Institution of Civil Engineers recently issued a statement justifying an increase in consulting engineers' fees over pre-war rates. With respect to reports, inquiries, parliamentary work and general advice on engineering matters the council is of the opinion that civil engineers are entitled to an advance of 50 per cent over former charges. These views have been supported by the British Association of Consulting Engineers.

Results of Completely Metering Omaha Water Supply

By F. P. Larmon
Chief Engineer, Metropolitan Water District of Omaha

Full metering of the water supply of the city of Omaha has resulted in a material saving in the amount of water pumped and in postponing for several years the enlargement of the pumping equipment. It has also contributed largely to the reduction in water rates which the Metropolitan Water District has been able to make from those charged by the Omaha Water Co. previous to the taking over of the plant by the district July 1, 1912.

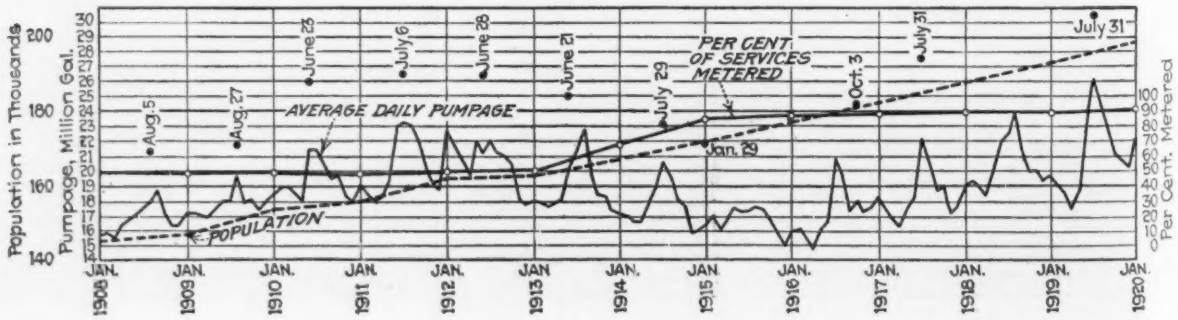
The water supply is lifted from the Missouri River to sedimentation basins, from which it is pumped into the distributing system. A part of this water is again lifted by booster pumps to a high service system. On account of the triple pumping of part of this water, any reduction in leakage or wastage is a material factor.

On the accompanying chart is shown the average amount pumped daily for each month from Jan. 1, 1908, to Jan. 1, 1920. The small circles represent the maximum amount pumped on any day for each year. A population curve and one showing the percentage of services metered are also added.

In 1899 the Omaha Water Co. had placed meters on about 25 per cent of its services. The number was gradually increased until in 1905 practically 50 per cent of the services were metered. This percentage held stationary until 1912 when the plant was taken over by the Metropolitan Water Board, which promptly took steps to meter the entire city. In 1913 about 67 per cent of the services were metered; in 1914 the percentage reached 84; in 1915 it was 87 per cent and on Jan. 1, 1920, out of a total of 34,632 recorded services, 31,573 were metered, representing 91 per cent. Deducting the number of services which were not in active use and from which meters had been removed, and also the city services, for which no charges are made, 98 per cent of the services are metered. The few unmetered special flat-rate services are rapidly being eliminated.

The chart shows a constant increase in amount pumped up to 1912, at which time, coincident with the introduction of more meters, the consumption decreased, although the population was steadily increasing. This condition prevailed until 1915 when practically all of the active services were metered. From that time on, the increase in consumption has been practically uniform and corresponds closely with the increase in population.

The average daily consumption per capita was 115 gal. in 1908 and increased each year up to 1912 at the rate



MONTHLY CONSUMPTION OF WATER IN OMAHA IN RELATION TO METERS AND POPULATION

of about 3 gal., so that in 1912 it was 128 gal. With the introduction of meters there came a decrease which continued until 1915, when the average daily consumption per capita was 94 gal. If the rate of increase previous to 1912 had been continued to 1915, the figure would then have been 136 gal., so there was an apparent saving of 42 gal. Since the completion of the metering program in 1915, the increase has been in about the same ratio per capita per year as it was in the period from 1908 to 1912. For the year 1919 the average daily consumption per capita was 107 gal. If the city had not been metered and the ratio had continued as shown prior to 1912, the average daily consumption per capita would probably have been 148 gal., or an increase of 41 gal. over the actual consumption.

Consumption High

The consumption is rather high, due to the large use of water by the stock yards and packing houses, to which is delivered nearly one-third of the water pumped. During the years 1918 and 1919 the use by these concerns was rather in excess of what it had been previous to that time, in the latter year accounting for 36 gal. out of the 107 gal. per capita.

HOW METERING AFFECTED THE TOTAL AND AVERAGE PER CAPITA CONSUMPTION AT OMAHA, NEB.

Year	Total Yearly Consumption in Million Gal.	Per Cent Metered	Average Daily Consumption per Capita	Probably Consumption if Not Fully Metered
1908	6,144	49	115	115
1909	6,480	49	118	118
1910	7,051	48	125	121
1911	7,375	49	121	124
1912	7,573	49	128	127
1913	6,932	67	116	130
1914	6,437	84	104	133
1915	5,943	87	94	136
1916	6,111	88	94	139
1917	6,515	89	97	142
1918	7,233	89	105	145
1919	7,616	91	107	148

While a conclusion as to what would have happened, had conditions of the period previous to 1912 continued, is in a way unsatisfactory and subject to criticism, yet it is believed that a study of the records of the amounts pumped before and after full metering, will justify the statement that the actual amount pumped in 1919 is at least 30 per cent less than it would have been if the system had not been fully metered. This reduction made a saving not only in the actual cost of pumping, but also made it possible to defer the enlargement of the pumping facilities from 1912 until 1918, at which time it was found advisable to replace one of the main pumps by a larger unit.

Canadian Power Statistics

Announcement has just been made by the Dominion Water Power Branch, Department of the Interior, of the central power station statistics of the Dominion of Canada as of Jan. 1, 1919. There were in the Dominion at that time 795 central stations, of which 377 were commercial and 418 municipal. These generated a total of 1,841,114 hp., or 2.09 hp. per thousand population. Of this 1,682,191 was generated by water power, or 91.4 per cent of the total. It is also reported that of the developed water power in the Dominion 72.7 per cent is utilized in connection with the central electric station industry.

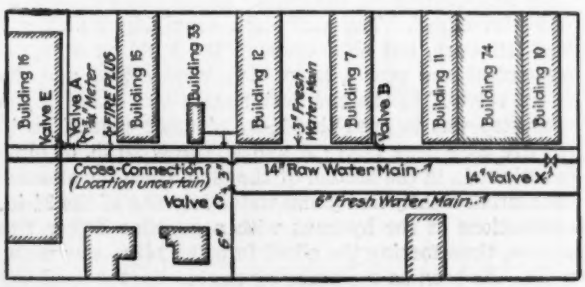
Leaky Cross-Connection Located by Alkali Test

By Lieut. W. Mack Angus and Carl Francis
Public Works Department, Navy Yard, Philadelphia

Because dual supplies of potable and raw or unfiltered water are in common use in industrial plants, especially shipyards where raw river water may be had merely for the pumping, the following description of a method used in locating a cross connection between dual supplies may be of interest. This dual system had given satisfactory service for many years when complaints suddenly arose of bad drinking water in several buildings in the plant, which covers some 900 acres and is laid out with streets and other features common to large modern shipyards. The first reports of bad tasting water were followed by a slight outbreak of dysentery and other intestinal disorders among the occupants of the buildings in the plant but there was no typhoid outbreak. As the trouble started immediately after putting some new raw water pumps in use which gave a material increase in pressure it seemed reasonable to suppose that some unknown cross connection between the raw water and fresh water systems was causing the trouble.

City water as it came to the plant had a decidedly unpleasant odor and taste at this time, due to ice on the river and consequent poor aëration of the raw water supply to the city's filters, so laboratory tests were decided upon to determine definitely whether or not the pollution was local or general. Ten lactose-peptone fermentation tubes were inoculated with water from each of a number of samples taken, 1 cc. of water being introduced into each tube. Specimens were taken from the pump house where the city pressure is boosted for use in the plant and other specimens were obtained from drinking fountains and wash basins in buildings from which complaints of bad water had been received and from other buildings in their vicinity. One tube of the ten prepared from the pump house specimen showed gas in 24 hr. while some of the specimens showed gas in all ten tubes within 18 hours.

All piping in the buildings where polluted samples had been obtained was next thoroughly examined and one small cross connection was found in this way. The connection had been made by a mechanic who evidently had wished to change the water supply to certain fixtures from raw water to city water and had deemed it safe to have a by-pass valve that would admit raw water to the potable water line in case of failure of the latter supply. This by-pass valve was leaking slightly and was thus polluting the water at one or two drinking fountains. The cross connection was removed and the attention of shop foremen called to regulations for-



ALKALI TEST TO LOCATE LEAKY CROSS-CONNECTION

bidding cross connections between the two water systems. A repetition of the test for gas forming organisms showed that there was still a serious local source of pollution, so the search for cross connections had to be continued.

This time the underground mains and not the piping systems in buildings were examined. Valves at street intersections were closed so as to give a definite direction of flow in all mains in and near the suspected area and fermentation tests were made. The trouble was thus almost definitely located as being somewhere on an old 3-in. main between valves *A* and *B*, in the accompanying sketch. This stretch of pipe had not hitherto been considered a likely location for the cross connection, as Buildings 7, 12 and 33 were all fed from the pipe in question and none of these buildings had made serious complaints of bad water. Closing valves *A*, *B* and *C* made the diagnosis of "cross connection somewhere between *A*. *B* and *C*" absolutely certain as water continued to run at high pressure from the fresh water faucets in buildings 7, 12 and 33. The fresh water connection to building 15 had previously been shut off as the building had been vacated preparatory to extensive alterations. The interior piping and plumbing systems of buildings 7, 12 and 33 were again examined for cross connections but none were found. Finally, the curb cocks for these buildings were shut off one at a time and the result of the shut down on the buildings supplied through the cock and the other buildings noted. As the closing of a curb cock in each case shut off the water from the building supplied through the cock, and did not shut off the water from the other buildings of the group, it was evident that the cross connection was in the 3 in. main proper and not in a supply line or service connection on the "building side" of the curb cock. Valves *A*, *B* and *C* were kept closed from this time on and occupants of buildings 7, 12 and 33 were warned not to drink water obtained in the buildings until further notice.

How Test Was Made

To get the actual location of the underground cross connection without digging up the entire length of pipe under suspicion was the next step. This was successfully carried out by using a modification of the alkali test described in *Engineering Record*, Sept. 13, 1913. The test was made by connecting a ¾-in. house meter with hose connections to an outlet made for the purpose in the main under suspicion near valve *A*. This connection was easily arranged in the manhole containing valves *A* and *E* and was itself provided with a globe valve for controlling the flow through the meter. This globe valve was closed, after a few cubic feet of water had been allowed to run through the meter, and the curb cock controlling the supply to buildings 12 and 33 was also closed. The curb cock supplying building 7 was left open, but all faucets in the building except a convenient one over a large sink were closed and the 14-in. valve *X* in the raw water main was closed. The next step was to open the 4½-in. steamer connection to the fire plug near valves *A* and *E*, throw 20 lb. of lump caustic soda in the bottom of the plug, close the steamer connection tightly and pump water *into* one of the 2½-in. connections of the hydrant with a gasoline driven fire engine, thus forcing the alkali into the 14-in. raw water main. As soon as the pumping engine started work the water running into the sink in building 7 was tested for alkalinity with phenolphthalein, a strong alkaline reaction being obtained after twenty minutes pumping, which showed that the caustic soda solution had worked down the 14-in. raw water main from the fire plug to the cross connection, through the cross connection to the 3-in. fresh water main and down this main to building 7. The spigot in building 7 was then shut off, the meter at *A* read carefully, and water was drawn through the meter until an alkaline reaction was obtained at this point. A second reading of the meter gave the contents of the pipe from the cross connection to the meter and as the main was of known size it was a simple matter to compute the distance back to the cross connection, proper corrections being made for the cubical contents of the meter and its connecting hoses.

It was feared that a leak between the cross connection and the meter might cause the test to fail by allowing the alkali to work from the cross connection to building 7, which would lead to the discovery of the leak and not the cross connection. This actually happened; a large leak being found within 5 in. of the location indicated by the test; but by good luck the cross connection was so near the leak that it was discovered while the leak was being excavated so that a repetition of the alkali test was unnecessary. The cross connection consisted of a 1½-in. pipe that had evidently been used to supply cooling water to a disused compressor in building 33. The dual supply had been provided with a valve on each main and a check to prevent raw water from getting into the potable water main. The check was out of order and both valves were wide open so that an almost unobstructed 1½-in. connection existed between the two mains. The connection, which was not shown on any drawing or blueprint, was removed entirely. It showed clearly the danger of any cross connections between raw and potable water systems except such connections as are located in boiler rooms where they may have the most careful supervision and attention, and even in such cases that cross connections are unsafe if protected by only one check valve.

A Water Project for Washington and Vicinity

In making studies of possible sources of water supply for the Washington Suburban Sanitary Commission, Robert B. Morse, chief engineer, Maryland State Board of Health, has found possibilities of developing a gravity water supply for a large part of the District of Columbia in conjunction with the needs of Maryland territory adjoining the District of Columbia. A report on this subject of Mr. Morse was printed under date of June 14, 1918. A second report, dated Dec. 15, 1919, has recently been published, in which Mr. Morse outlines two projects involving ultimately the utilization of water from the three Patuxent Rivers, the northwest branch, and Rock Creek. The first project contemplates the ultimate development of 170,000,000 gal. a day and the immediate development of 100,000,000 gal. The other project is for 200,000,000 and 130,000,000 gal. respectively. Various dams or filtration plants and a conduit would be required in each case. No estimate of cost has yet been made. The Washington Suburban Sanitary Commission (611 F St., N. W., Washington, D. C.) was incorporated by the Maryland Legislature in 1918. It is already building small waterworks for portions of the territory under its jurisdiction.

Flint Water Filter Improvements and Reconstruction

Michigan City Outgrows Capacity in Four Years—Dry-Chemical Feed Replaces Wet Method—Softening Provided For

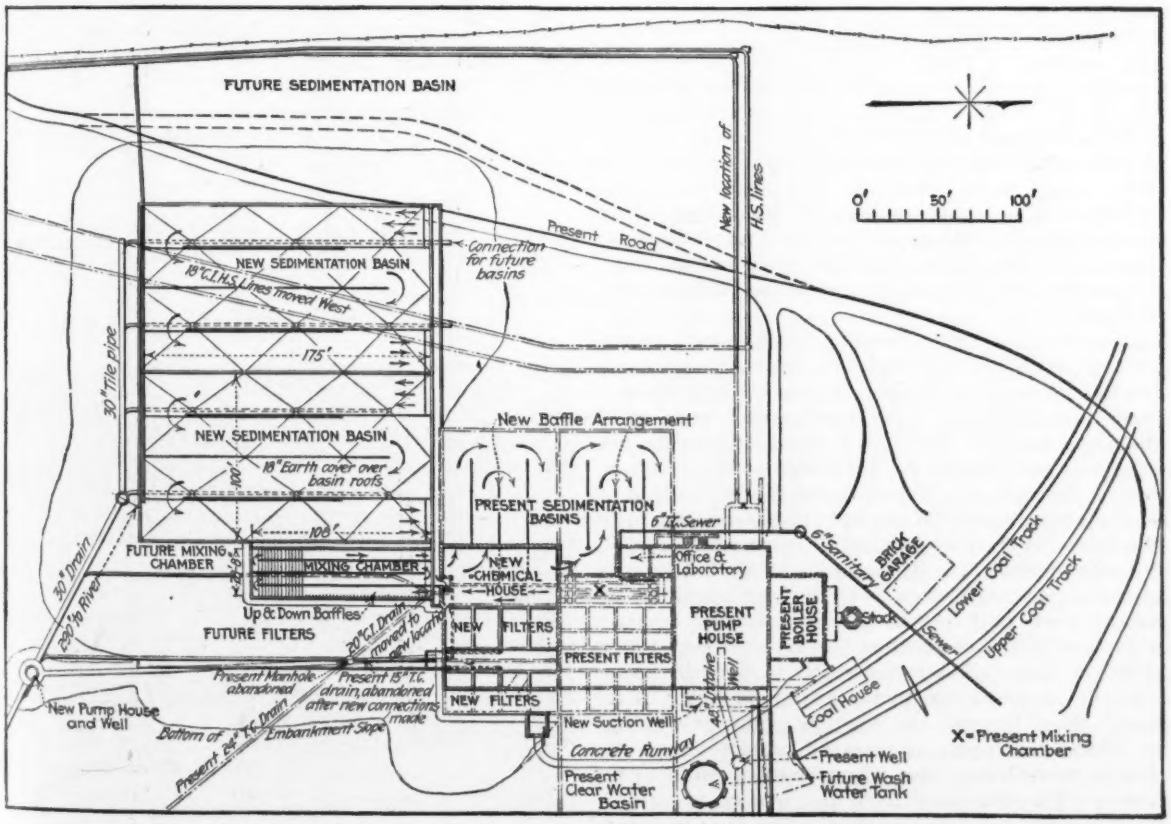
SO RAPID has been the growth of Flint, Mich., that the water filtration plant completed in 1912 needed enlargement in four years instead of the expected twenty years later. The war so delayed construction that the new work was not completed until 1919. Reconstruction, including a change from wet to dry chemical feed, was carried on with the old filters in full operation. The plant as it now stands is probably the first one designed throughout for the use of chemicals in a dry state, although 25 or 30 other plants have had their chemical feed changed from the solution to the dry type.

The original plant, built by the Pittsburgh Filter Manufacturing Co., from plans prepared by W. G. Clark, consulting engineer, Toledo, Ohio, had a nominal capacity of 8,000,000 gal. daily. This capacity has been doubled, with provision for an increase to 36,000,000 gal., and also for water softening.

The new construction consists of two settling basins of 2,250,000 gal. capacity each; a baffled mixing chamber; eight additional filter units of 1,000,000 gal. capacity each; a new head house and chemical storage building; a new laboratory; chemical feeding devices; and a new intake and suction well, the entire work costing somewhat in excess of $300,000.

The old settling basins, with a 3½-hour detention period and a velocity of 1¾ ft. per minute, were found to be too small for economical results. At the nominal daily rate of 16,000,000 gal., the new settling basins, which are 16 ft. deep, will have a 7-hours detention period and the same velocity as the old basins when operated in parallel. The new basins have flat slab floors and roofs, and each is provided with six openings to the drains for cleaning. A 6-in. flushing pressure line, with 4-in. branches on the baffle wall, is laid along one end of the basins. Distribution of the water over the full cross-section at the inlets is effected by a 6-in. baffle wall, 4½ ft. in front of the inlet gate, perforated with 3-in. holes, 9-in. c. to c. both ways over a 9 x 25-ft. area. Choice of this method of securing a uniform distribution was based on reports of its satisfactory use in several other plants. The discharge from the basins is over a solid baffle wall with four stop-plank openings at the top, 4 ft. deep and 5¼ ft. long.

Through the new mixing chamber, with its four channels 6¾ ft. wide and 20½ ft. deep, the water makes a passage of the 108-ft. length four times, but the design is such that from one-fourth to the entire capacity of the chamber may be used. The up-and-down plank baffles are spaced 2 ft. c. to c. but the grooves in the walls are on 12-in. centers so that different arrangements may be made. All "over" baffles have swinging 18 x 24-in. wood flap gates at the bottom to equalize any unbalanced pressures while draining and to permit such sediment as may collect to be flushed to one of the two drain pipe openings provided. The maximum loss of head was calculated to be 4 ft., but will vary according to the arrangement of baffles. As operated, the maximum recorded has not exceeded 30 in. The old



LAYOUT OF RECONSTRUCTED WATER FILTRATION PLANT AT FLINT, MICHIGAN

mixer, in which the water remained for 10½ min. and passed at a velocity of 0.4 ft. per second, gave fairly good results with alum but proved inadequate when lime and iron were used. The greatest velocity assumed for the new basins is 0.5 ft. per second. There has been no settling in the new chambers. Should a deposit occur ample provision is made for its removal through sludge valves.

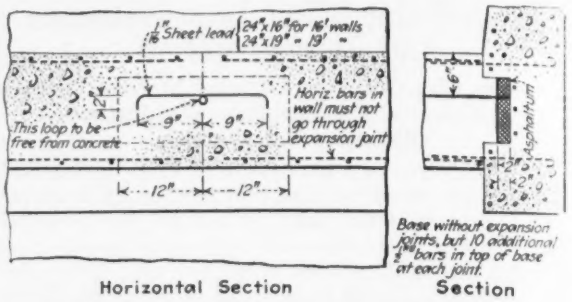
The filters are of the usual type, equipped with air and water manifolds. Each controller responds to a master controller operated from the clear well, water in which is maintained at a pre-determined level.

Eight reinforced-concrete self-supporting hopper-bottom bins provide storage for from 10 to 12 cars of

FOUR-PASS MIXING CHAMBER WITH UP-AND-DOWN WOOD BAFFLES

chemicals. On the charging floor above them additional flat storage is available. The chemical is transferred at the unloading building from cars onto a storage battery car by which it is transported over an elevated concrete runway to an elevator in a tower at the rear of the new filters. Six of the bins, storing hydrated lime, are connected to three dry-feed-machine hoppers by chutes with slide gates, and the other two bins, for alum or for iron sulphate, are each connected to separate machines.

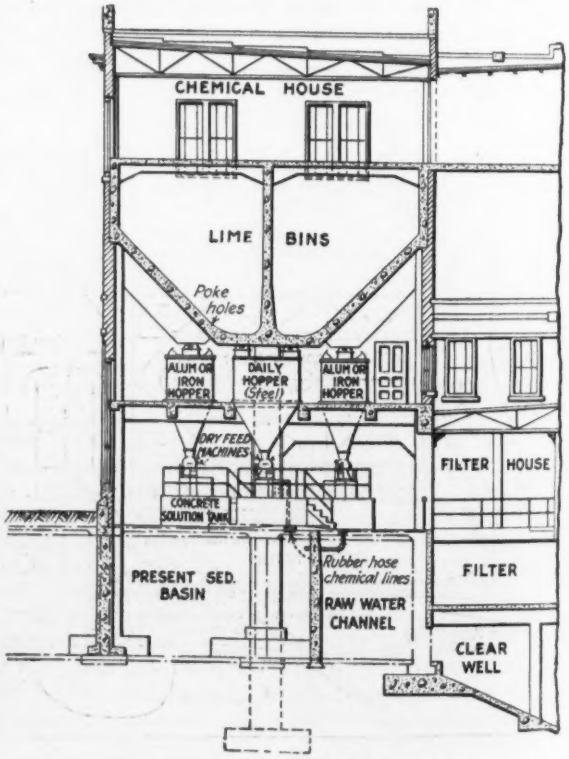
From the hopper bins the feed is entirely by gravity and dry until it has passed the measuring machines. The latter consist of a cast-iron housing into which is fitted a motor-driven corrugated drum wheel upon which the material rests. The wheel carries the material forward through an adjustable orifice. The degree of opening, and, therefore, the rate of feed, is indicated by a pointer on one side of the frame. Wide adjustment of feed is obtained in three ways: (1) By the orifice opening. (2) By the adjustment of the ratchet operating the feed wheel. (3) By the speed of the motor. Each machine will discharge with an accuracy of from 95 to 98 per cent at the rate of from 100 to 16,000 lb. daily. The motor speed is controlled automatically in proportion to the supply of water to the plant. Head through the Venturi meter on the supply line to the basins actuates an equal pressure diaphragm operating a valve which supplies water to the motors. The discharge from the motors is used in dissolving the powdered material after it is measured out, but more water may be added to obtain any degree



EXPANSION JOINT FOR SEDIMENTATION BASIN

of dilution necessary to avoid the corrosive action of the chemicals. Rubber hose is used to carry the solutions to the point of application.

The most difficult construction feature arose from the necessity of maintaining uninterrupted service. This problem was by no means easy as the old mixing chambers had to be reconstructed, the old settling basins altered, the chemical plant removed entirely and a new intake and suction well cut in. The work was so planned and executed that only for a few hours was it necessary for the city to obtain a supply directly from the river, and that at a time when the raw water was at its best. The procedure was as follows: The settling basins, headhouse and chemical equipment and new filter units with the clear well below the filter boxes were practically completed ready for use with the old plant maintained in operation. For a considerable period it was necessary to operate with one basin only, since columns supporting the building and the storage bins were constructed in the second basin. There was constructed also, in the end of this basin, a portion of the conduit carrying the water



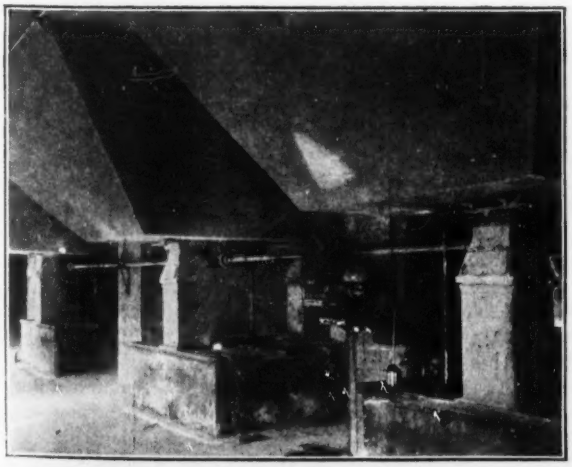
CROSS-SECTION OF CHEMICAL HOUSE

from the inlet well to the mixing chamber. When this point in the new construction was reached the old mixing chamber was put out of commission and reconstructed to form the completed conduit to the new mixing chamber. The top of the conduit was covered to sustain an upward pressure on it due to a head of 3 ft.

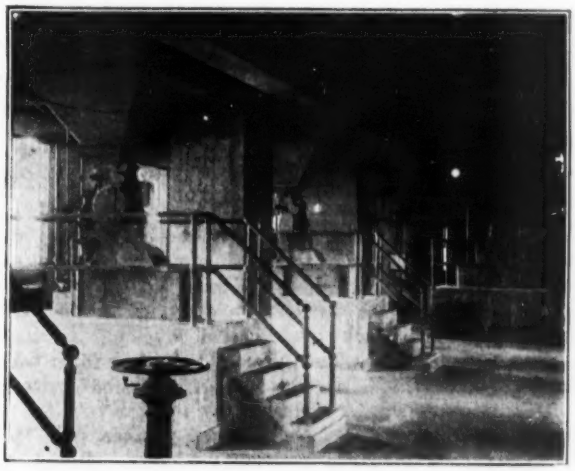
When the supply conduit between the new and old filters was connected, the plant had to be closed down for a few hours to permit bulkheads to be built, forms erected and the concrete to get an initial set. After removal of the bulkheads the water was turned into the new mixing chamber, settling basins and filters, but it was then necessary to make a connection between the new clear water basin and the old one. The work was done from a float in the old clear well. A tight bulkhead provided with packing was sunk against the wall of the basin at the point of the desired opening. By means of a pipe through the bulkhead the water on the wall side was drawn out so that the pressure of the water in the basin would keep the bulkhead in place while an opening was cut through from the opposite side of the wall.

A new intake was built because the 3½-ft. brick conduit, 500 ft. long, connected directly to the suction of the low lift pumps, was slowly filling with a sand deposit. From the new intake a 48-in. reinforced-concrete conduit leads to a new suction well 10 ft. wide and 40 ft. long. The well extends below the outside wall of the existing station, necessitating a new foundation wall, which was built in sections. The old conduit was left intact and inclosed in the walls of the suction well while the well construction was under way. As the well is divided into sections so arranged that either conduit may be thrown out of commission, there was no interruption of service in changing over to the new intake. The suctions of two of the low service pumps were connected into the new well and used while the old conduit was cut off. The portion passing through the well was removed and a sluice gate fitted to the end entering the well.

To enlarge the plant to its ultimate capacity, no interruptions will be required in the operations, since special provisions have been made to add filter units, basins and clear well by cast-iron frame openings covered with removable plates.



HOPPER BOTTOMS OF CHEMICAL STORAGE BINS WITH CHUTES TO DRY-FEED MACHINES



CHEMICAL ROOM WITH DRY-FEED MACHINES

The additions to the plant were designed and constructed by the Pittsburgh Filter Manufacturing Co., under the general direction of F. N. Baldwin, superintendent of waterworks.

Screw Spikes on Electric Railways

IN the electric railway field, a recent questionnaire covering the screw spike question, circulated by one of the large Eastern companies, resulted in replies the majority of which indicated that electric railway engineers have not found the use of the screw spike justifiable for ordinary electric railway conditions either in private right-of-way or in paved streets. Here it may be noted that the screw spike is not used either in the New York subways or upon the elevated roads, except under certain conditions at stations and other special locations.

We are inclined to the belief that the cut spike will continue as the standard rail fastening for electric railways, but attention is called to the point that recent experiments made at the civil engineering laboratories of Columbia University indicate the value of preboring holes in the ties to receive the spikes. The crushing and bunching of the wood fibers is thus materially reduced and the elasticity of the fibers, upon which the resistance to withdrawal partly depends, is retained to a far greater degree and over a longer period. It should also be noted that preboring should be done before creosoting or other treatment is applied. Attention is again called to the desirability of making new comparative tests of standard cut spikes made with the regular chisel point and with the Goldie or diamond point. The latter should prove the better of the two because its shape should lessen the crushing and bunching of the wood fibers, due to its better cutting action, and it is believed that the Goldie point will insure the best results when driven in prebored holes. Upon occasion it may be necessary to resort to double spiking in order to reduce the load which each spike must sustain in resisting withdrawal, and it will be found advisable to give close attention to such details if the most effective use of the cut spike is to be obtained.—*Electric Railway Journal.*

Sandwashers for the Drifting-Sand Rapid Water Filter

With Particular Reference to Experience at Toronto — Loss-of-Head Studies and Sand Scour Lead to Changes in Details

By William Gore
Of Gore, Nasmith & Storrie, Consulting Engineers, Toronto, Ont.

THE drifting-sand filter system which has been established at the water-works of Toronto, Ont., and elsewhere depends for its successful application upon the efficient working of continuously operated sandwashers. These washers have something in common with the ejector sandwashers developed for use with slow sand filters, but differ in that they form part of a closed hydraulic system and are required to work with a minimum water pressure with water practically unlimited in quantity. While water pressures of 120 lb. per square inch are commonly adopted with slow-sand ejector washers, these are called upon to work with pressures of $\frac{1}{100}$ of that amount.

The system with a sandwasher applied to a single unit is illustrated in Fig. 1. The treated raw water enters the filter partly by a standpipe running through the center of the unit, which passes up through a separator or sandwasher in the bottom and delivers above the sand at the top of the pipe, and also partly through a bypass. Within the sandwasher the raw water pipe is formed, similar to that of the tube of a venturi water meter, and the difting sand, after being collected and washed in the sandwasher, is inducted into the raw water at the throat of this venturi tube. The sand passes up the standpipe with the raw coagulated water, and is delivered with it above the top of the sand already there. This sand forms a volcano-like cone that continuously drifts away and is continually being replaced with the washed sand from the sandwasher, leaving a round-topped body of stationary sand below, resting upon the filtered water collecting system. This body of stationary sand does the final filtration. The surface of this body is more than twice the plan area of the unit and is the actual filtering surface, thus economizing the plan area of the filters. The drifting sand passes down all around the boundary of the stationary sand to a system of slots and continues through a system of converging ports to the outlets on the external extractors and thence by a system of pipes to the sandwasher. At the sandwasher the sand falls to the bottom through a current of raw water and is thus freed from its impurities. It is picked up by the inductor and carried on to the filter as previously described. The dirty water, impurities or suspended matter pass upward and out at the top of the sandwasher by an outlet suitably controlled. In the external extractors sand traps are placed of such a form that the sand is kept out of the piping system except when the inductor is in full operation. That is to say, the sand moves only when there is an abundance of running water to carry it forward to the sandwasher and from the sandwasher back again into the filter.

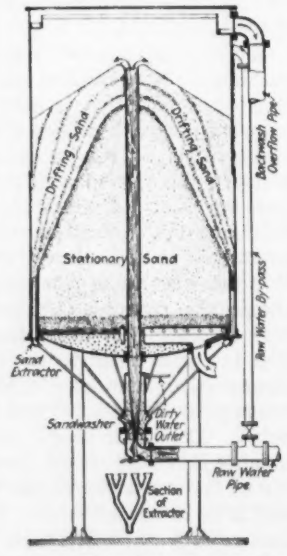


FIG. 1. TYPICAL SECTION OF DRIFTING-SAND FILTER UNIT

There are 30 of these units in each of the 10 filters of the Toronto plant. Each unit has a washer and 264 sand extractors connected with the washer by inclined pipes.

LOSS OF HEAD IN TYPICAL DRIFTING-SAND FILTER

Duration of Run, Hr.	Rate of Filtration, Millions Imp. Gal. per Acre per Day Based on Plan Area	Loss of Head in Sand-washer, Ft.	Loss of Head in Filtering through Drifting Sand, Ft.	Loss of Head in Filtering through Stationary Sand and Underdrains, Ft.	Induction Head Provided by Sandwasher, Ft.	Diff. of Head at Bottom o. Drifting Sand and in Washer, Ft. Col. 6—Col. 4	Remarks
0	150	3.0	3.6	2.3	5.1	1.5	1 grain per gal. of alum
5	150	2.6	5.2	1.7	6.1	0.9	
10	150	2.6	5.1	1.9	6.0	0.9	
15	150	2.5	3.8	1.8	4.8	1.0	
20	150	2.5	3.3	2.1	4.3	1.0	
25	150	2.5	3.2	2.4	4.1	0.9	
30	150	2.4	4.0	2.4	4.7	0.7	
35	150	2.4	4.1	2.5	4.8	0.6	
40	150	2.5	3.9	2.8	4.7	0.8	
45	150	2.5	4.0	2.8	4.8	0.8	
50	150	2.5	3.7	2.6	4.3	0.6	
55	150	2.6	3.7	2.7	4.4	0.7	
60	150	2.4	3.4	2.7	4.2	0.8	
65	150	2.5	3.3	2.7	4.0	0.7	
70	150	2.4	3.2	2.7	3.8	0.6	
75	150	2.4	3.7	2.9	4.3	0.6	No co-agulant
80	150	2.3	3.3	2.9	3.9	0.6	
85	150	2.3	3.4	3.2	4.1	0.7	
90	150	2.5	3.8	3.5	4.6	0.8	
95	150	2.6	3.5	3.7	4.4	0.9	
100	150	2.6	4.1	4.0	4.9	0.8	1 grain iron sulphate and ½ grain lime
105	150	2.8	4.9	4.2	5.6	0.7	
110	150	4.2	5.6	4.6	6.5	0.9	
115	150	4.2	5.3	4.5	6.2	0.9	
120	150	4.2	5.4	4.8	6.4	1.0	

The main difficulty so far experienced with this system has been the erosion of the metal parts of the sandwasher where the sand and water are moving at high velocity or with unsteady motion. The erosion has taken place in the throat of the venturi tube, in the sand nozzle which conveys the cleansed sand from the bottom of the washer to the throat, and in the bottom of the washer itself, and a good deal of research work has been carried out in order to get rid of this erosion.

In the earlier washers side delivery of the sand to the ejector throat was adopted, but more recently the longitudinal or trailing nozzle delivery has been adhered to except for small units. The adoption of the trailing sand nozzle arose from experiments carried out at Toronto in 1915 with an 8-ft. 7-in. diameter filter unit similar to Fig. 1, and equal in area to one of the 30 units which make up the Toronto plant. [For a detailed description of the 72,000,000-U. S. gal. plant at Toronto see *Engineeriny News*, Sept. 21, 1916, p. 566, and for contract test results and operating results see *Engineering News-Record*, Oct. 31, 1918, p. 817, and Oct. 30-Nov. 6, 1919, p. 822—Editor.]

The more important part, that is, the base, of the sandwasher, as finally developed by the experiments, is shown by Fig. 2. A run at the full rate during 400 hr. using this sandwasher, did not disclose any scour whatever. It was believed that the problem of scour had been satisfactorily solved, and subsequent events have proved this to be the case. [The subject of scour and the further development of the sandwasher is taken up again further on—Editor]

To make clear the nature of the work the sandwasher

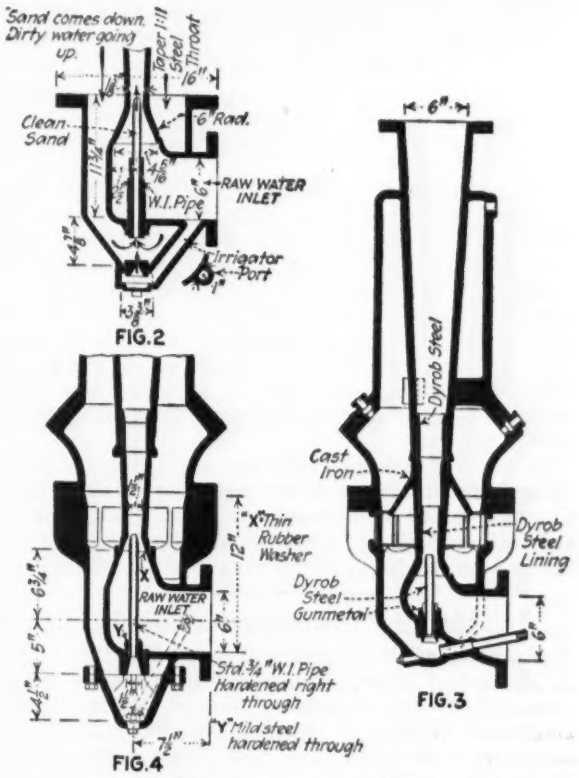
is called upon to do, the accompanying table is given. It shows observations of the various losses of head in the typical drifting-sand filter. The observations were made upon the test filter during a run of 120 hours, but during working hours only, the water being pumped from a local pond in which there was a considerable amount of suspended matter. The figures apply almost equally well to the Toronto plant, as sand of the same depth and quality is used, with water containing, on the whole, less suspended matter of a vegetable origin but more of a mineral origin.

During most of this test about two-thirds of the water being filtered was passed through the sandwasher, and the remainder bypassed to the top of the filter. At the first set of observations, and again when the filter began to clog after 110 hr. an increased proportion of water was sent through the sandwasher. This is shown in column 3 by the increased losses of head.

The drifting-sand filter has very definite loss-of-head characteristics which are brought out by the table and these affect the working of the sandwasher. These characteristics have been studied in considerable detail. It will be noted that under normal working conditions, an induction head (column 6) of less than 5 ft. is required in the sandwasher body. During the early hours of a run a maximum slowly develops and fades away again. This is due to the effect of the flat sand surface remaining immediately after a backwash. Another maximum develops towards the end of the run. This appears to be due to a less effective drift of the sand, as clogging takes place in the stationary sand which increases in bulk and area at the expense of the drifting sand, reducing the filtration area of the drifting sand. The greater part of the induction head provided by the sandwasher ejector is taken up by the filtration losses in the drifting sand (column 4). Thus, if no filtration was in progress, an induction head of 1 ft. or less (column 7) is all that is necessary to cause the sand to circulate. But as the water passing through the sandwasher throat has to be filtered or sent to waste, the practical minimum limit with a normally designed plant is about 50 per cent of the rated output, and the simplest working conditions are found at about 66 per cent of the rated output. The loss of head in the stationary sand (column 5) has very little effect on the operation of the sandwasher. This loss follows the normal law of filtration loss of head. That is to say, there are slow increased losses of head at the beginning of a run which increase as the run proceeds.

In summing up the experience with the test filter sandwasher two points appeared to require further consideration. One was that the irrigation water jet at the bottom of the washer would foul with sand occasionally after shutting down the filter, and the other that the sand nozzle (13½ in. in length), was rather long and absorbed by friction more head than was thought necessary. In the design for the actual sandwasher bases for the Toronto plant (Fig. 3) both of these defects were removed.

Some experience with Toronto sandwashers (Fig. 3) disclosed a local erosion in the throat at a point opposite the main water inlet, which reduced the efficiency of the ejector, and it was found necessary to line the throat of the venturi tube. This has been conveniently done with carbonized wrought-iron pipe in steps, as shown. The smallest diameter tube required renewal about



CHANGES IN DESIGN OF SANDWASHER

(2) Base of washer in experimental filter. (3) Original design for Toronto plant. (4) New base for Toronto filter.

every four months and the intermediate one yearly. The sand nozzles last a full year and the scour at the bottom of the washer has had to be repaired once in three years. These experiences being so different from what might have been anticipated from the experiments with the test filter, it was decided to study the matter in further detail.

A sandwasher base from one of the filters was connected up to an independent source of water supply, with the water jet and sand nozzle exposed, and it was found that the velocity of the water at the jet varied from point to point in a given plane normal to the direction of motion; it being greatest at the point of maximum scour and at least at a point diametrically opposite. At the point of highest velocity there was the greatest suction with the result that the sand coming out of the nozzle was drawn toward that point. There was also at this point considerable turbulence owing to it being on the line of coalescence of the two streams of water formed by the sand nozzle acting as an obstruction in the fairway of the water. By comparing the two designs, the cause of the difference in the experiences is apparent. In the test filter design (Fig. 2) the water passing to the throat does so from a comparatively quiescent large body of water, and forms a comparatively steady jet, while in the adopted design (Fig. 3) the spaces provided were restricted, and the water passed at moderate velocities past the sand nozzle and up around the bend, hugging its periphery, producing the disturbances noted.

It was decided to introduce at two points in one of the Toronto filters sandwasher bases corresponding in the form of the water passages closely to those of the

test filter. The actual design is shown by Fig. 4. A considerable improvement in the bottom of the sandwasher was introduced and the sand nozzles were formed so as to be drawn out from below. These have been in operation over twelve months and show very little scour, and none at the bottom of the washer, and they run without attention.

As a matter of performance, each of these sandwashers during the twelve months they have been in operation have properly washed and cleaned about 5,000 tons of sand, withdrawing it from, and delivering it again to, a height of about 18 ft., with practically no attention, and the throats and sand nozzles are still in good condition. This is considered to be highly satisfactory, and shows that these sandwashers are highly efficient machines. The work of installing new sandwasher bases and throats throughout the whole plant is now in progress.

In the sandwasher recently applied to pressure filters at Rockland, Ont., the raw-water supply pipe as it enters the sandwasher is widened out from 4 to 6 in. to reduce the velocity of approach with the idea of maintaining the steady jet at the throat of the sandwasher.

Barges and Towboats for Mississippi

IN a paper entitled "Design of Barge Fleet for Upper Mississippi River," presented at the recent spring meeting of the American Society of Mechanical Engineers, William S. Mitchell describes the barges and tow boats which are now being built by the United States Engineer Department for Mississippi River navigation. The barges are 300 ft. long, 48 ft. wide, and 10 ft. deep, the width allowing three barges to be grouped about each tow boat. Such a barge will carry 850 tons of cargo on a draft of 4 ft. during low water, increasing at high stages to 2,500 tons on an 8-ft. draft when going upstream, and to 3,000 tons on 9-ft. draft when floating over the rapids coming downstream. The dimensions are fixed just within the physical limits set by bridges and locks in the river reach to be navigated, that is, up to St. Paul. The barges are of the semi-hopper type having a hold 5 ft. deep over part of their length and width, the hoppers being 256 ft. long, 36 ft. wide, and 6 ft. deep. Side tanks or pontoons can be used for expansion tanks or storage space for liquid cargoes. The barges are of steel on easy lines. The loaded economical speed is calculated at 5¼ miles per hour, and at this speed and 3½-ft. draft the resistance was found on trial to be 1.7 lb. per ton of displacement, about one-third less than the resistance of standard short rake scow-bowed barges. The tow boats are of the stern paddle wheel Western river type, with a low-water draft of 4 ft. at the bow and 3 ft. at the stern. They are the largest stern-wheel tow boats, with one exception, ever built. The hulls are 230 ft. long, 58 ft. beam, and 8 ft. deep. They will displace about 1,100 tons when under steam. Each boat is equipped with two Heine cross-drum, marine type boilers, 4,250 sq.ft. of heating surface, and 100 sq.ft. grate surface, and twin tandem compound condensing 24-in. high-pressure and 48-in. low-pressure cylinders, with an 8-ft. stroke, designed for an initial pressure of 250 lb. with steam superheat of about 75°. Each boat is equipped with two sets of balanced rudders, one set of four rudders fitted at the stern transom forward of the wheel, and the other set of two rudders fitted aft of the wheel.

Detroit's New 350-Million Gallon Filtration Plant

Old Open Reservoir to Be Covered for Filtered Water—Short Mixing Chamber—Steel Roof Over Coagulation Basin

BY THEODORE A. LEISEN
Civil Engineer, Detroit Water Works

CONSTRUCTION of the largest water filtration plant in the country began in April at Detroit, following the award of a contract for building the substructure of a low-lift pumping station which will deliver water from the present intake conduits to the first element of the purifying plant. The Walsh Construction Co., of Davenport, Iowa, is the contractor. When this station is completed, two units of the ultimate installation of five centrifugal pumps are to be placed for suction booster service in connection with the existing high-pressure pumping station during periods of low water. It is expected that the pile foundations of the filters and coagulating basin will be placed under contract before the end of the 1920 season, to be followed next year by construction of the coagulating basins and filters themselves. The last element of the work will be the reconstruction of the existing open raw-water settling reservoir, whereby it is to be converted into a covered filtered-water basin. The completion of this work will represent the final development of water supply at the present pumping station in Water-Works Park, as the distribution facilities here are limited by the street space available for outgoing mains. It will provide for the city's growth of the next eight or ten years it is estimated.

As a whole the plant represents standard modern practice in rapid filtration, with but minor modifications, and follows in practically all details the general preliminary plans prepared by the writer in 1917. In its structural design, however, the plant has a number of individual features, resulting from the local conditions which the designers had to meet. The filters and coagulation basins will both be constructed substantially on the surface of the ground and will in effect be ordinary concrete buildings with walls strong enough to resist the pressure of the contained water, and covered by a steel truss roof of ordinary mill-building type. The subsoil is not considered reliable enough to carry the structures direct, and piles will therefore be driven all over the site to take the load down to solid ground. The filtered-water basin will be of a standard construction, consisting of groined flat-arch invert and roof, and concrete columns, but the conditions under which this structure will be built are quite unusual, as it is to occupy the present raw-water settling reservoir. The sloping side embankments of the latter are to be excavated, vertical side walls of the new basin built, the bottom excavated and piles driven for the new floor and column foundations. The finished basin roof will be covered with soil for lawn or garden.

In the operative design of the plant attention may be directed to the short mixing chamber with close-set baffles, so arranged as to give alternately transverse and vertical baffling. This chamber is designed for a relatively high velocity of flow, in the view that mixing is a physical rather than a chemical operation. Up to the outflow gates of the mixing chamber the plant is

single, but beyond these gates it is in duplicate or multiple, so that entire flexibility of operation is assured. An element in which many filter houses are troublesome in operation, the valve arrangement in the pipe gallery, has in this plant been made the object of elaborate study, and it is believed exceptional simplicity has been attained, so that valve and pipe trouble in operation should be almost wholly eliminated. The arrangement of the piping will be shown at a later date, when contract plans are completed. The plant as a whole has been designed for convenience in operation, the placing of all of the operative parts in a contracted area and under one roof having been done with this in view.

While full working details of all parts of the plant have not yet been elaborated, the designing having been delayed by the interruption of work on account of the war, the general plan has been fixed, in accordance with the accompanying Fig. 1, which shows the relative arrangement of the different elements of the plant. The structural disposition of the various elements will be as shown on the section Fig. 2. Details are being worked out at present by the writer, with F. H. Stephenson as associate engineer.

On account of the large quantity of ice and also of hair-like vegetable débris carried by the water in certain seasons, rotary screens are provided for at the inlet end of the low-lift pumping station (see Fig. 1). These screens consist of seven units, each 33 ft. long vertically between centers of roller shafts, and 6 ft. wide, covered with 14-gage copper wire, three meshes to the inch. They are to be motor operated independently at a rate of 10 ft. per minute, and will be cleaned automatically while in operation. Prior to completion of the basins and filters, the low-lift station will discharge by way of the two present conduits to the pressure pumps; later these conduits will be supplied instead from the effluent conduit of the filter house, while the low-lift pumps will discharge by way of a short lateral connection to the mixing chamber.

One of the sections in Fig. 2 shows the compact arrangement of the mixing chamber and the alternately horizontal and vertical baffling, as well as the position of the two 8½ x 14-ft. outlet gates to the coagulating basin. Each of these basins has a flow length of about 1,000 ft. and a mean cross-section of about 1,500 sq.ft., which will give a normal velocity of less than 10 ft. per minute. Floor drains in the basins permit of washing the sediment to a transverse sewer crossing the site under the basins.

From the conduit which collects the settled effluent at the discharge end of the coagulation basin the water passes to the supply channels of the filter house, just north of the basins. The filters are in rectangular arrangement, in five double sets of eight boxes each. The effluent is collected by a concrete conduit extending east and west under the floor of the filter house to a connection with the conduit leading to the filtered water basin and the pressure pumps. Wash water for the filters is stored in two tanks in the third story of the

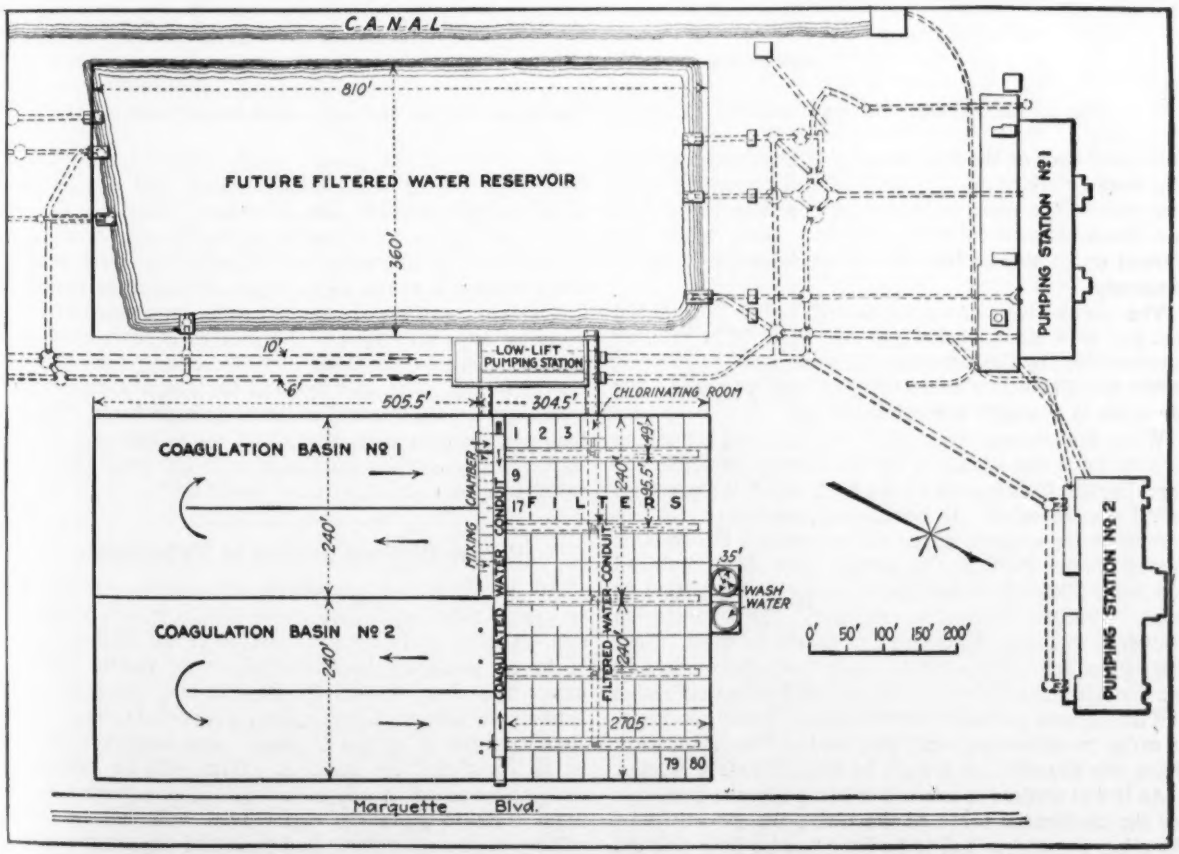


FIG. 1. NEW DETROIT FILTER PLANT WILL REPRESENT ULTIMATE DEVELOPMENT OF PRESENT WATER-WORKS SITE

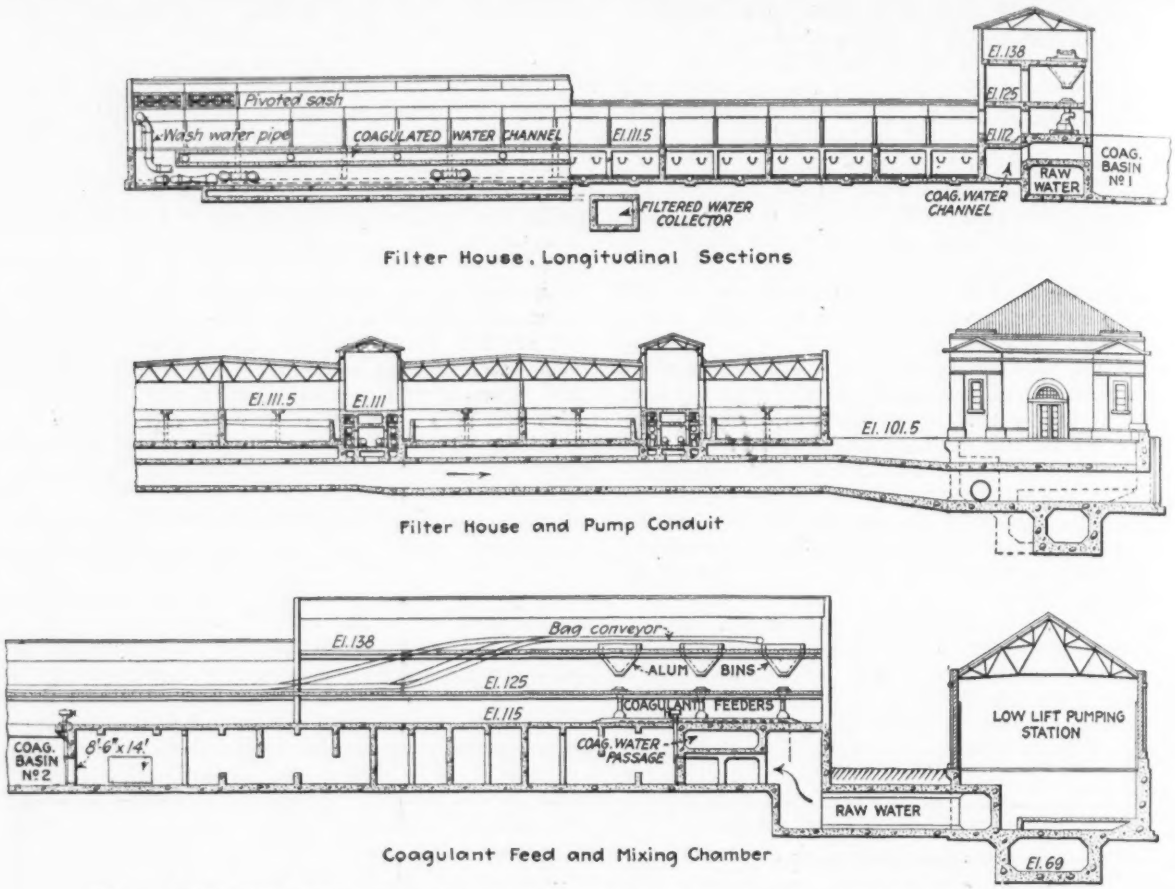


FIG. 2. SECTIONAL VIEWS OF MIXING CHAMBER, COAGULATION BASIN HOUSE AND FILTER HOUSE

entrance tower of the filter house. A chlorinating room has been provided on the level of the operating floor, over one of the filter beds, and in line with the end of the filtered water collecting conduit, from which the filtered water may be treated with chlorine gas if found necessary.

The normal rate of operation will be at 160,000,000 gal. per acre, or 4,000,000 gal. per bed. This rate, as demonstrated by the experimental work, can be increased safely to 175,000,000 or 180,000,000 gal. per acre. No air wash is provided nor contemplated.

When the site was explored by borings and soundings to determine the character of the ground available for carrying the foundations of the filter plant, the presence of fill was revealed. It was known, moreover, that in former years a small water course crossed the present Water-Works Park to the river. The filled material has not sufficiently consolidated since its deposition to form a secure foundation stratum. The conclusion therefore was that the entire site should be piled. Concrete piles are being used to carry the substructure of the low-lift pumping station and pump foundation basins and filters, and probably for the filtered water reservoir. In order to maintain proper progress of the entire work these pile foundations should be started before winter.

As it was desired to use the existing storage reservoir for the clearwater basin of the plant, the elevations of the other structures had to be fixed to suit both this old reservoir and the suction wells of the pumping stations. The coagulation basins and filters are therefore necessarily placed above ground level. On the east these structures border a residential street and a pleasing architectural exterior was therefore desired. Filter house and basins were treated as a unit architecturally. In structure they consist of unbroken concrete walls, brick veneered, about 15 ft. high, developed on the exterior into piers and recessed panels, surmounted by a building superstructure. The roof is carried by steel trusses, those in the filter house spanning each single line of filters, 48 ft. and those in the coagulation basins spanning 118 ft., the half width of a single basin. These long span trusses are spaced 36 ft. on centers and carry lattice-girder purlins on which rest the roof slabs of reinforced concrete or gypsum "pyrobar."

Refuse Disposal Studies at Philadelphia

An investigation to secure information on which to base a plan for future street cleaning, ash, rubbish and garbage collection and disposal at Philadelphia is to be made by the Department of Public Works under the direction of E. B. Morden, chief of the Bureau of Street Cleaning, and Edward D. Very, assistant engineer of the Bureau. The investigation is to be completed by Aug. 1. Data will be collected by employees of the department. It is expected that from time to time the department will call in consulting engineers having had practical experience with the various phases of the subjects which are now under consideration.

Concrete Destroyed in Vacuum in Calaveras Dam Culvert

Experience in Temporary Intake Led to Successful Use of Vent Pipes to Break Vacuum in New Design

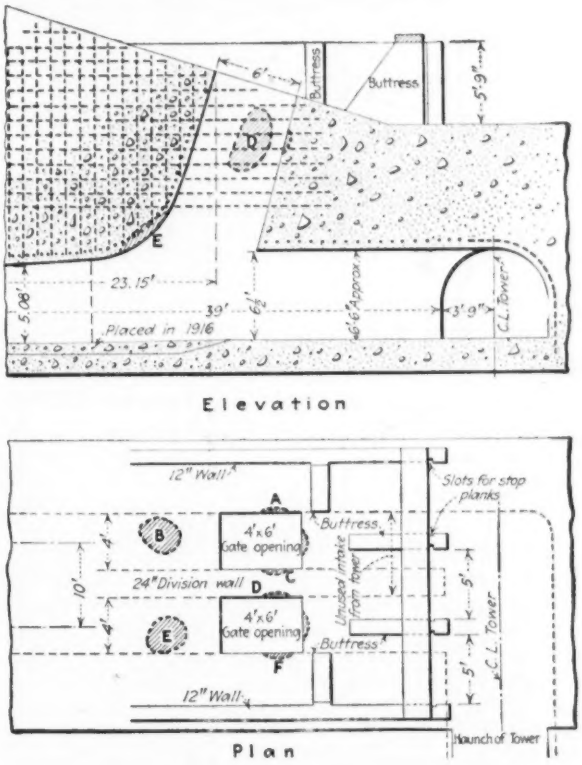
CONCRETE was disintegrated and eaten away to a serious extent by vacuum in the headworks of the culvert under the Calaveras dam of the Spring Valley Water Co., San Francisco, where an intake had been provided for temporary use in controlling storage waters during construction. At first there was some doubt as to the cause of the damage, but this was cleared up later. That the conclusions reached were correct is indicated by the fact that in the similar outlet which has since been built for permanent service damage from vacuum was entirely prevented by the use of vent pipes.

In the headworks where damage from vacuum occurred, five gates were provided, the arrangement and dimensions of the passage-ways into which they lead being as shown in the accompanying sketch. After water had been passing through this intake at heads up to 35 ft. for about two weeks, the concrete surfaces were found to have been disintegrated at the points *A*, *B*, *C* and *D*, *E*, *F*. At some of these points the concrete was gone to a depth of about 4 in. The most severe disintegration occurred at *B* and *E*.

It is notable that the location of the damaged spots corresponds exactly in the two passage-ways. The disintegration at *B* and *E* are on the top of the passage-way toward the side opposite the division wall. In addition to these two points of greatest damage there were several places where less severe effect was found and for the most part the location of the points of lesser damage corresponded in the two passage-ways.

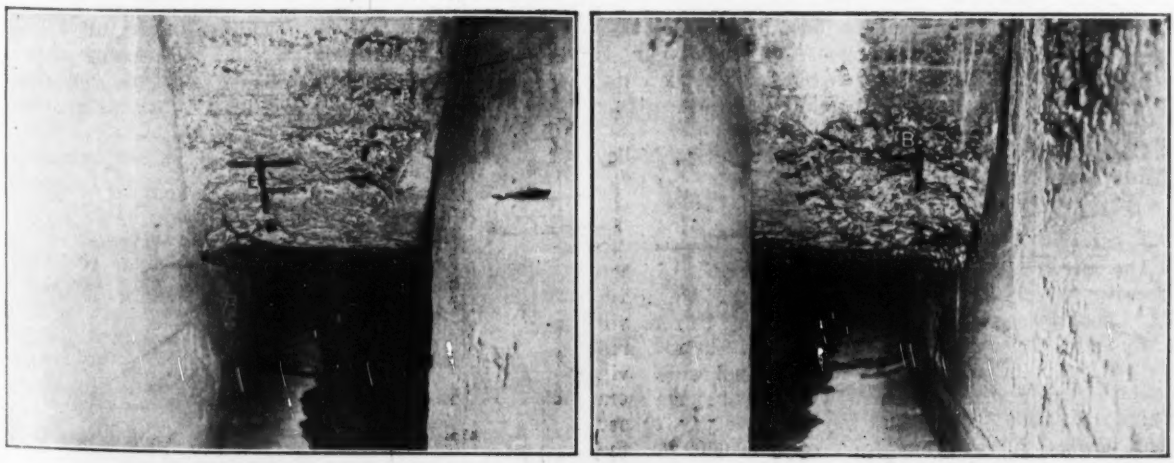
Evidence that the damage was not caused by erosion was found first in the way the destruction occurred on the end of the diversion wall. Instead of having rounded corners this was eaten away to a depth of several inches, square across the ends of the wall and the surface left was rough and jagged, wholly unlike the result of erosion by water currents.

There is no question about the quality of the concrete, according to engineers in charge of construction. During the work tests were made frequently on the concrete, using 6-in. cylinders 8 in. long. These showed a compressive strength of 2,800 lb. per square inch. The proportions of the mix in the headworks was 1 : 2 : 4. These materials were washed and screened and the rock was graded in two sizes. Because of the use of reinforcing in the head works the concrete specified there was of a somewhat better grade than that in the culvert itself which is of mass construction.

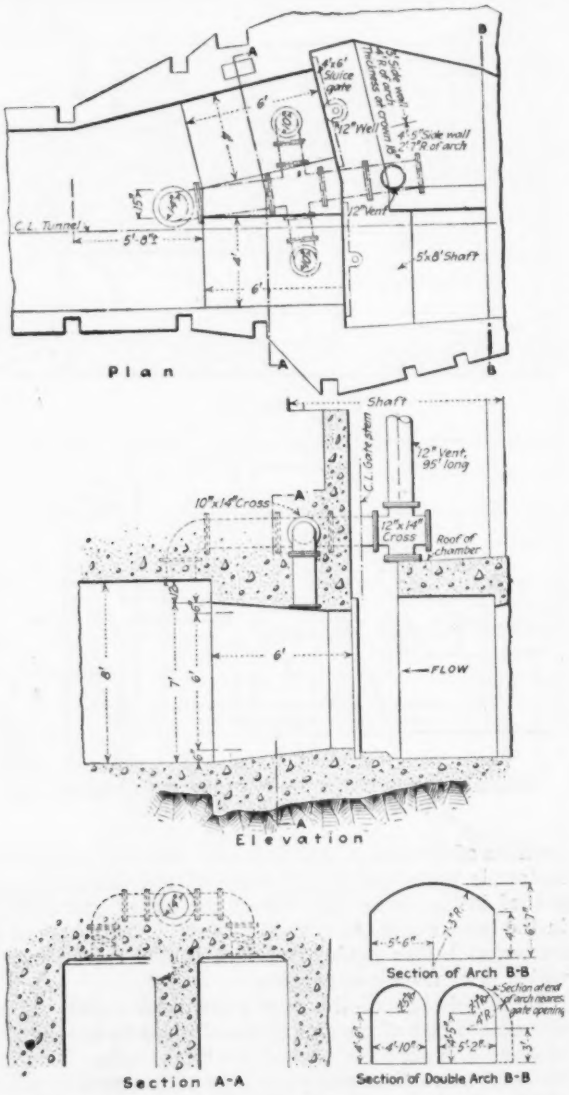


CONCRETE TORN OUT IN VACUUM OF TEMPORARY CULVERT TO CALAVERAS DAM

In the design of the new permanent outlet tunnel around one end of the dam it was desired to enlarge the cross-section suddenly beyond the intake gate. This introduced much the same conditions with regard to probability of vacuum effect as in the temporary head works in the culvert under the dam. However, a 12-in. vent pipe was led into this intake with three openings, as shown in the accompanying illustration.



TEMPORARY CULVERT SHOWING LOCATION OF DESTROYED CONCRETE



NEW CULVERT WITH VENT PIPES TO BREAK VACUUM IN CALAVERAS DAM

During the past season water has passed through this new intake continuously for three months under heads ranging up to 65 ft. without having caused any damage whatever to the concrete lining of the tunnel. Air is drawn into the upper end of this vent pipe at velocities so high that it has not been possible to measure them with instruments thus far tried.

G. A. Elliott is chief engineer of the Spring Valley Water Co.

Chicago Housing Project

The first 175 houses of 10,000 planned by the Chicago Housing Association are nearing completion. More than 3,000 applications have been made for them. Buyers will pay about $35 per month, of which $10 will be rent and the balance will be applied on the principal which will be liquidated in about 15 years. The houses range from $4,000 to $4,500 in cost and buyers must pay 10 per cent down. A revolving fund of $750,000 for the project has been pledged.

Water Jets and Sand Blast Clean St. Louis Filters

Jets Set in Beds for Five Hours Cut Coating from Sand Grains and Break Up Mud Balls— Blast Opens Strainer Holes

By C. M. Daily
Engineer in Charge, Supply and Purifying Section, St. Louis Water Division

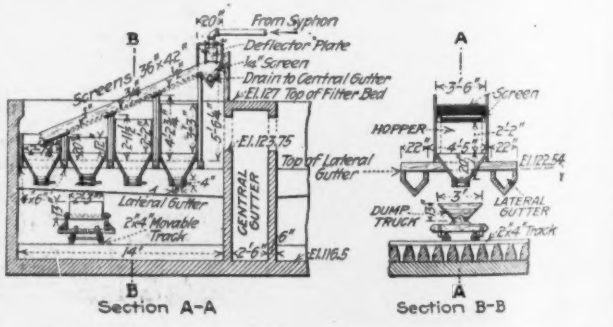
In the 4½-year period of operation of the water filtration plant at St. Louis, Mo., many things have developed which probably are not common to all rapid filters but throw light on filter operation in general. Among them are the accumulation of mud through the sand and along the sides of the bed, the coating of the sand and gravel and their tendency to cement together. The sand and gravel have been cleaned mechanically by water jets, and a sand blast machine has been developed to clean out the holes in the strainer plates.

The plant was put in operation May 15, 1915, and it has remained continuously in service, filtering 4,390 million gallons of water through each unit, which required 994 washings. The water filtered had an average turbidity of 15 parts per million.

Originally the filtering material was composed of 30 in. of sand and 12 in. of gravel. The gravel complied with the specifications requiring the bottom 5 in. to be screened through a 1½-in. screen and be retained on a ¾-in. screen, the 4-in. second layer to pass through a ¾-in. screen and be retained on a ⅜-in. screen, and the 3-in. third layer to pass through a ⅜-in. screen and be retained on a ⅛-in. screen.

The sand specifications called for an effective size of from 0.4 to 0.5 mm., and for a uniformity coefficient not over 1.65. In many of the units the sand was much finer than specified, the average effective size being 0.34 mm. and the average uniformity coefficient 1.81. In the units where the specifications were complied with the filters were equally as efficient in the removal of turbidity and in some instances required less than 60 per cent as many washings as the units having the finer sand.

Mud balls were noticed after the plant had been operated a few months. The formation was caused by too low a rate of wash, about 18 in. vertical rise per minute, which broke up the layer of sediment on top of the sand into fragments large enough to resist the action of the wash water tending to carry it in suspension. By coalescence the mud balls became of such size that they gradually worked their way downward through the sand while washing, or they were thrown



GRAVEL SCREENS, HOPPERS AND DUMP TRUCK

to a point where the upward rise of the wash water was the weakest, forming hard patches throughout the bed and against the sides of the filters. At first these patches were broken up by pulling a screen of ¼-in. mesh through the sand while washing. The rate of wash water was increased to 24 in. vertical rise per minute, but the strainer system was found clogged in spots, producing conditions favorable for mud-ball formation, which occurred in so many places as to necessitate the removal of the sand and gravel and the cleaning by hand of the holes in the strainer plates. Since the holes numbered more than 102,000 per filtering unit, the cleaning operation was a slow and tedious job shunned by all the men in the plant.

In the spring of 1918 a coating on the sand was found to have increased the effective size to 0.381 mm., reducing the uniformity coefficient to 1.43. The depth of sand was reduced to 28 in. The percentage of sand under 0.25 mm. in size had decreased from 2.59 to 0.61.

The necessary change in the filter plant operation, developed during 1918, reduced the sand to an average depth of 26 in. and increased the length of run between washings about 35 per cent without decreasing the quality of the filtrate. The rate of washing was increased to about 27 in. vertical rise per minute in order to eliminate the mud balls, if possible. This caused the finer sand to be carried away, thereby increasing the amount of water filtered between washings. In the spring of 1919 the sand was found to be caking badly. The grains were held together by a soft coating which could be removed slowly by washing, but which was very hard to dissolve. Hard patches appeared on the beds, and the wash water distribution became very unequal. Investigation showed that the gravel also was slightly cemented together. Although improved operating conditions have been reported in another plant after the gravel was cemented no improvement was noted in St. Louis and steps were taken to remove the cementing material.

The total quantity of coating on the sand averaged 7.01 per cent of its weight and on the gravel 1.93 per cent. Careful study of the problem of cleaning the sand and gravel economically was made by means of experimental apparatus constructed in the plant. These experiments led to the construction of the improved apparatus now in use, which consists of four water jets with ¾-in. nozzles, and 1½- to 2¾-in. throats; 4-in. discharge pipes; a gravel screen having four sizes of separation and a hopper under each screen; a truck for hauling the screened gravel, and a sand blast machine for cleaning the holes in the strainer plates.

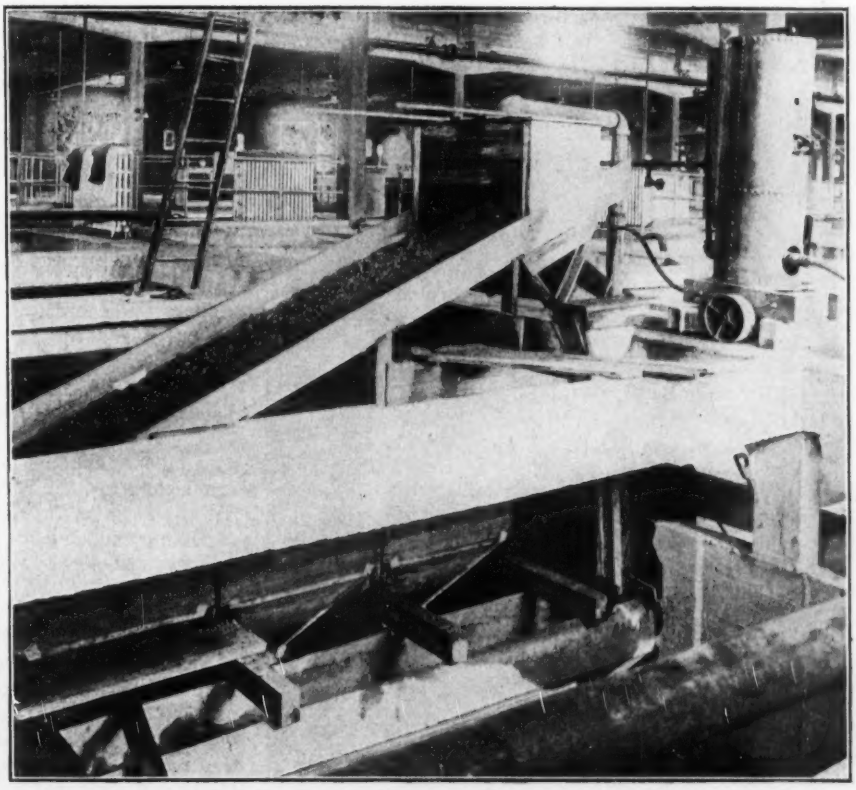
The sand is cleaned by the water jets, one being placed in each half of a filter bed on top of the sand. The jets discharge into the opposite half of the bed through a wooden box, 12 in. square and 4 ft. deep, containing a series of sloping screens. Water at 100 lb. pressure is used in the jets.

ANALYSIS OF THE COATING ON THE SAND AND GRAVEL

	Sand, Per Cent	Gravel, Per Cent
SiO_2	0 4	0 5
$Fe(OH)_3$	12 9	33 0
$Al(OH)_3$	17 3	17 1
$CaCO_3$	45 7	48 9
$CaSo_4$	0 3	0 1
$Mg(OH)_2$	10 0	0 4
Clay	13.4	0 0

In operation, wash water is turned on at from one-tenth to one-fourth the normal rate. The sand bed thus softened allows the jets to sink through to the gravel. The slowly rising wash water furnishes the means of transporting the sand from the discharge of one jet to the suction of the other at the opposite end of same half of the bed. As the waste wash water flows out through the trough to the sewer, it carries away the coating removed by the scouring action of the water and the sand passing through the jets and screens.

The sand washing is continued for about five hours without the aid of manual labor. At the end of that time the discharge from the jets is still turbid but an average of 2.14 per cent of weight is removed, amounting to 7,000 lb. per filter. The 4.87 per cent of coating still remaining on the sand is further reduced by about ½ per cent by jetting the sand from one half of the filter to the other half in which the clean gravel has been screened and properly placed. During the experimental work half a bed was jetted into the other half without washing. The coating scoured off the sand, settled in a layer on the bed, and could not be



GRAVEL SCREEN AND HOPPERS IN PLACE—SAND BLAST TANK AT RIGHT

removed by the ordinary process of washing the filter. It was only broken up into small pieces or mud balls.

It was found economical to remove and store all the sand from one bed and the gravel from one-half of the bed at one end of the plant in order to have room to screen and place the gravel and clean the strainer plates. When the gravel and sand had been cleaned in 39 of the 40 filters and the remaining filter was filled with the gravel and sand removed and set aside from the first filter.

For cleaning the gravel and strainer plates, a sand blast is used, beginning with strainer plates in the half bed from which all material has been removed. When these plates are cleaned the gravel from the adjoining half bed is shoveled into a jet and discharged into a box which diverts to the sewer the water escaping through the screens. The gravel, assisted by men with rakes, rolls over stationary screens and drops into four hoppers suspended from the wash water gutters. It is discharged from the hoppers into a small truck which is wheeled and dumped on the half bed where the strainer plates have been cleaned. Sand from the half filter adjoining the one from which the gravel was removed is now jetted onto the cleaned gravel in place. The lower 2 in. of sand is shoveled into the jet; the remainder flows to the jet as described previously.

CLEANING STRAINER PLATES WITH A SAND BLAST

The sand blast requires a 30-lb. air pressure and is supplied with sand passing through a screen with 20 meshes to the inch. About 1 cu.yd. of sand is used per filter bed. A $\frac{7}{16}$-in. nozzle is used, made by drawing down a $\frac{1}{2}$-in. pipe and drilling to size. One man cleans the plates in one-half bed per day. More than 97 per cent of the holes are opened and the top sides of the plates are scoured bright. On the under side was found a coating which still remains. Analysis indicated the following composition in percentages: ZnO, 38.7; SiO_2, 2.9; CuO, 41.0; Al_2O_3, 3.0; PB So$_4$, 2.2; Loss on ignition, 10.6.

GRAVEL JET WITH V-SHAPED FEED BOX

In passing through the jets and over the screens the gravel from one bed has about 450 lb. of coating removed. Whatever coating remains is hard and has no tendency to cement the gravel together. More than half of the plant has been cleaned. Although the sand still has 4 per cent of coating it has no tendency to cement together and the effective size remains below that required by the specification. Probably the entire plant will be cleaned by May, and, barring the loss of 4 in. of sand during the 4½ years of operation, the plant will be as efficient and in as good condition as when installed, the operating force wiser in the art of filter operation and the trouble experienced in the past will be more easily remedied in the future.

The cost of the work per filter unit is as follows: Labor, $169; wash water, $88; tap water, $9; total, $266. The wash water was estimated at $20.60 per million gallons, and the tap water at $19.61. The washing and cleaning plant cost $750, or $18.75 per filter unit, but it will be useful for future work. The cost per filter of jetting the sand for five hours was $35.50, divided as follows: Labor, $2; wash water, $31; tap water, $2.50.

Sieve Tests Check Closely

According to a report from the U. S. Bureau of Standards, a cement company recently sent around to a number of laboratories a sample of cement with a request for a 200-mesh sieve determination, in order that the results as obtained in the different laboratories might be compared. It was found that the extreme variation was only 0.3 per cent.

Tests of Solid and Laminated Wood Sheetpiles

Laboratory Tests on Quarter-Scale Models Under Bending Loads

DISTINCT superiority of solid over compound or laminated wooden sheetpiles is indicated by the results of some bending tests on model piles, made several years ago but not reported hitherto. The relative transverse strength and stiffness of the two types of pile and the efficiency of three types of fastenings were studied.

FIG. 1. SECTIONS OF SHEETPILES TESTED FOR STRENGTH

The tests were made at Cornell University in 1915 by Prof. A. P. Mills, using 15 piles furnished by J. W. Pearl, Chicago, who gives the present information as to the results. There were five types of piles (Fig. 1),

TABLE I. COMPARATIVE STRENGTH OF WOOD SHEET PILES OF DIFFERENT TYPES (See Fig. 1)

Type	Transverse Load, Per Cent.	Deflection Under Trans. Load, Per Cent.	Resistance to Splitting at X Pile 6 In. Thick, Per Cent.	Pile 12 In. Thick, Per Cent.
1	100	100	100	100
2	100	100	90	75
3	100	100	90	75
4	80	125	45	37½
5	67	30	50	50

Types of Piles: 1, Solid; grooved both sides, easy to drive and pull and stop leaks; high salvage. 2, Groove and tongue-shaped out of solid wood, making 25% waste; expensive. 3. Grooved both sides but tongue spiked in one groove; hard to pull and to stop leaks. 4. Three pieces spiked on square timber to form tongue and groove; weak and liable to leak. 5. Laminated interlocking pile, low strength, high deflection and low salvage.

three specimens of each type. The strength comparison for the five types is given in Table I. No tests were made with two or more piles interlocked. All test piles were of yellow pine and were 3 in. thick, 3¾ in. wide and 9 ft. long, representing piles 12 x 15 in., 36 ft. long, to quarter scale. Variable loads were applied at eight points through a system of levers (see Fig. 3) so arranged as to reproduce the shears and moments that would result from earth or water pressure increasing uniformly from the top to the bottom in a pile secured at the top by a tie-rod or waling timber and at the bottom by the earth penetrated. The reaction was distributed over four points of support near the toe and concentrated at a single point near the head. A test in progress is shown in the view Fig. 2. The results of tests on laminated piles built up in three ways are shown in Table II. The first two columns represent sticks 3 x 3¾-in.; the second being grooved at both ends for splines; the other three columns represent piles made of three 1 x 3¾-in. planks. Pile C had fastenings of eight ½-in. oak pins or trenails and two ¾-in. bolts at head, six trenails and two bolts at toe and 24 wire 8-d. nails in central portion. Pile D had four bolts at each end and 34 nails. Pile E had 10 bolts at head and eight at toe, and 24 nails. All bolts, trenails and nails were in two rows, driven in equal numbers from opposite sides, staggered and with the spacing varied to approximate the variation in shearing stress along the pile.

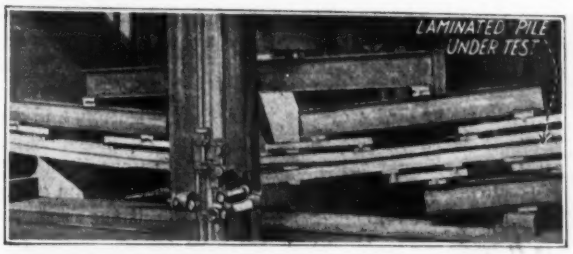


FIG. 2. LAMINATED WOOD SHEETPILE IN TESTING MACHINE

TABLE II. TESTS OF MODELS OF WOOD SHEETPILES

	Solid Stick	Solid Grooved	Laminated C	Laminated D	Laminated E
Av. ultimate load, lb.	7000	8023	5667	4813	4933
Failure	Broken	Broken	Cracked	(a)	(b)
Deflect. at 3000 lb., in.	1.73	1.43	3.90	3.88	4.00
Deflect at 4500 lb., in.	2.65	2.06	6.20	6.30	6.80
Av. slip at free end; 3000-lb. load			0.11	0.096	0.112
Av. slip at free end; 4500-lb. load			0.189	.....	0.173
Av. slip at max. shear; 3000-lb. load			0.120	0.099	0.111
Av. slip at max. shear; 4500-lb. load			0.207	.....	0.179

NOTE—(a) Cracked, 2; flexure, 1. (b) Cracked, 1; flexure, 2.

In all tests the loads were applied progressively in equal increments of 500 lb., and the deflections at six points were noted for each increment. In the laminated piles, the slippage for each increment was measured at

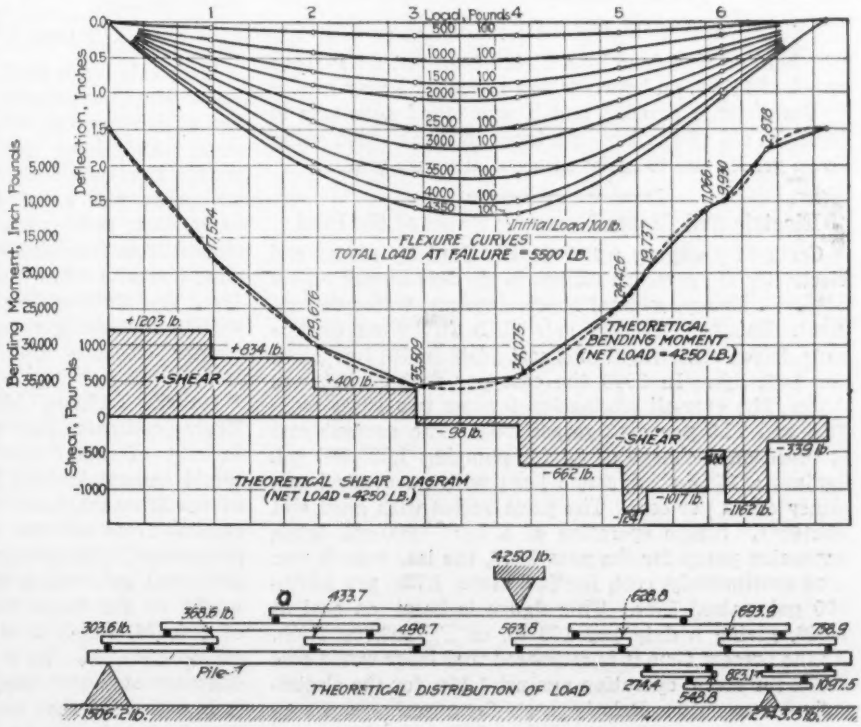


FIG. 3. DIAGRAM OF TEST ON SHEETPILES

the point of support of the free end or head and at the maximum shear point, which was about 30 in. from the toe. The loads were increased until fracture resulted or the deflection reached the limit of the equipment.

Within the limits of the tests the deflection and the slippage were closely proportional to the loads. Slippage on the upper joint was about 8% more than that on the lower joint, while at the point of maximum shear the slippage was about 4% greater than at the free end.

Truck Carries 16-Ton Load Over Mountain Roads

INCIDENT to the construction work on the Barret dam, a new unit in the water conservation system for the city of San Diego, Cal., now under way, one of the heaviest jobs of hauling by auto truck over dirt roads ever done in that section was accomplished without mishap. This consisted of the transfer from the lower Otay Dam, recently completed, to the Barret damsite, a distance of 28 mi., of the body or main shell of a gyratory rock crusher, the single piece weighing 16½ tons.

SIXTEEN-TON LOAD ON 5½-TON TRUCK

The hauling was done by a 5½-ton truck, at an average speed of 1½ mi. an hour. There are many heavy grades in the distance covered, and it was found necessary to have the aid of another auto truck to check speed going down grades and to assist in negotiating up-grades.

Electric and Steam Pumping Costs at St. Paul

Costs of pumping water in St. Paul by steam and electricity are given as follows in the last annual report of J. W. Kelsey, general superintendent, water department. Raising 1,000,000 gal. 152.3 ft. by an electrically driven centrifugal unit cost $3.48 in 1918 or 2.28c. for 1-ft. lift. In 1919 the cost per foot of lift was 2.34c. The over-all efficiencies for the two years were 79.5 and 78.5 per cent respectively. The current cost is based on a charge of $4 for pumping 1,000,000 gal. against a 158.5-ft. dynamic head with an over-all efficiency of 72 per cent. The price varies with head and efficiency. Steam operation of a 10,000,000-gal. triple expansion pump for the year 1916, the last year it was used continuously, cost, for fuel alone, 1.73c per 1,000,000 gal. raised 1 ft. This figure is based on coal at $4.40, giving a duty per 100 lb. of [illegible]03,700 ft.-lb. At the present time it is estimated that labor would cost 2.16c. for steam operation against 1.11c. for the electrically driven units. Relative costs for miscellaneous supplies and repairs are estimated at 0.55 and 0.32c., making a total of 4.44c. for steam and 3.71c. for electricity.

Railway Water Consumption and Waste Prevention

Numerous Plants with Private or Purchased Supply Aggregate Large Consumption—Methods of Reducing Use and Waste

WATER consumption by railways for locomotives, shops, stations and general purposes aggregates about 900,000,000,000 gal. annually. At an average cost of 7c. per 1,000 gal. (exclusive of interest and depreciation) it represents an expenditure of $63,000,000 a year. The foregoing figures include approximately 13,000 water stations for supplying locomotives. These figures were given at a meeting of the Western Society of Engineers by C. R. Knowles, superintendent of water service, Illinois Central R. R. They are supported in a report by F. D. Yeaton, assistant engineer of the Chicago, Milwaukee & St. Paul Ry., who estimates a total consumption of 2,000,000,000 gal. daily at an average cost of over 5c. per 1,000 gal. The latter further gives an average of 8,000 gal. per mile per day, as on his road this consumption ranges from 2,000 gal. on branch lines to 10,000 gal. on the main line. A saving of 10 to 18 per cent in total annual consumption is considered practicable.

An analysis of the consumption of 15,622,000 gal. of water on the Illinois Central R. R. showed that 77 per cent was obtained from 230 railway pumping stations and 23 per cent from 232 city and private waterworks plants. About 74 per cent of the total was used by the locomotives, 12 per cent for washing and filling locomotive boilers, 8½ per cent for sanitary and domestic purposes and 5½ per cent for stationary power plants. On the Chicago, Milwaukee & St. Paul Ry. about 80 per cent of the water supply is furnished by the railway and 20 per cent is purchased from municipalities.

Water Waste Prevention

With this large total water consumption at scattered water-supply systems of various sizes and types there are such numerous opportunities for waste that railways which have undertaken waste prevention campaigns have found them productive of direct financial saving as well as of improved conditions. Waste is particularly serious when it includes water that is purchased from municipalities, as this is of relatively high cost, and also when the water has been given a purifying or softening treatment. Such treatment by railways is increasing steadily in order to secure increased service efficiency and reduced repair costs for the locomotives.

On the Chicago, Milwaukee & St. Paul Ry., Mr. Yeaton estimates that a saving of at least 10 per cent in cost of water purchased can be effected, which would amount to $107,000 annually. On its lines east of the Missouri River this road has 28 terminals consuming from 100,000 to 2,700,000 gal. daily and aggregating 11,220,000 gal. At an average cost of 5c. per 1,000 gal., which he considers a low figure, there would be for these stations alone an annual saving of $20,476, which at 6 per cent represents the interest on $341,366. In a recent report by A. B. Pierce, engineer of water supply, Southern Railway System, it is estimated that an annual saving of $119,999 can be effected by waste prevention and more efficient operation of water stations.

A water-waste prevention campaign on the Illinois Central R. R. during the five years 1915-1919 resulted in an average saving of $65,379 or nearly $200 daily. As an illustration, a comparison was made of 14 of the largest water stations using city water, these stations representing 70 per cent of the total consumption and 62 per cent of the total cost of city water. During the five-year period the consumption was reduced by 2,270,595,830 gal. with an actual saving of $135,435 on the water bills, as compared with the year 1914. This reduction represents the checking of waste and improper use. At the same time, the tonnage handled showed an increase of 28 per cent, increasing the water consumption at least 10 per cent and thus adding a further saving of $131,420.

During this five-year period the water pumped at the railway plants was reduced 5 per cent, which at 2c. per 1,000 gal. effected a saving of $60,038. Thus for the five years there was a total saving of $326,894 in cost of water. Opportunities for further saving are considered to be large, as the cost of water at many points has increased materially.

Causes of Waste of Water

Waste may occur in the delivery and distribution of water by pump slippage, broken and leaky mains and service pipes, leaky valves and hydrants and defective plumbing. Waste by improper or careless use of water may include overfilling of tender tanks, letting water run from faucets or hose, using leaky hose and connections, opening hydrants for drinking or miscellaneous purposes and then failing to close them properly. Waste by defective valves and plumbing in wash rooms and toilets at railway stations, shops and engine terminals is a prevalent condition. It has been shown that leakage by improperly adjusted valves in toilet tanks may cause a loss of $3 to $50 a month, depending on the number of fixtures and the cost of water. In one case, the defective toilet facilities at a large terminal were found to be causing a loss of over $400 a month in cost of water.

Overfilling tender tanks is so conspicuous that it is likely to receive attention, but it is really one of the minor forms of waste and its correction is easier than that of the innumerable small leaks and wastes where water is running continually. A source of extensive waste is at engine ashpits where cinders are cooled or washed down by means of a hose, the water being left running when the hose is not in use. Water columns and tank fittings are often leaky, causing not only waste of water but trouble with ice on the track in winter. A specific case on the Union Pacific Ry. was neglect of a defective float valve on a boiler washing plant at a roundhouse, with the result that water costing 30c. per 1,000 gal. was allowed to flow into the sewer at the rate of 180,000 gal. daily.

At engine terminals and roundhouses there is much waste from leaky valves and connections, boiler washout plants, feed-water heaters, wash basins, toilets and appliances directly connected to sewers or drains. Hydrants at coach yards and railway stockyards are likely to be leaky and misused. Hydrants for watering passenger cars are in the same condition and are often allowed to run freely, with the excuse of delivering cool water in summer and preventing freezing in winter. Cooling water for air compressors and internal combustion engines is often allowed to run to waste.

Much of this waste can be checked by close and systematic supervision under the direction of some official who is held responsible for proper conditions and has authority to order repairs. One railway has instituted measurements of normal consumption at different points as a check upon future records. At treating plants, close account is kept of the water pumped and water and chemicals used. Education of employees as to the losses by waste is important and must be carried on continually to be effective. Aids in this direction are circulars and talks explaining sources of waste, its cost and how to reduce it. Printed notices may be posted in enginehouses and shops, but these need to be renewed or changed occasionally or they will cease to attract attention.

Waste prevention devices, visible indicators and audible warnings may be applied in many ways. Indicators on tender tanks have been suggested, to show the fireman when to begin closing the standpipe valve so that the tank may be filled without overflowing. At water stations on the Southern Railway, Mr. Pierce, engineer of water service, has introduced automatic controlling valves in concrete pits, which can be inspected and repaired more readily than float valves in high tanks. He has applied air chambers and relief valves on long pipe lines to reduce water hammer and leakage; also electric signals to notify pump men when the elevated tanks are filled, so as to prevent overflow.

In conclusion, the following is quoted from the paper by Mr. Knowles, already mentioned, in regard to the waste-prevention campaign on the Illinois Central R. R.:

> This saving (nearly $200 per day) has been accomplished by investigating every possible source of waste and keeping the importance of the subject constantly before officer and employee. The principal saving was made in the cost of city water and efforts were directed chiefly toward correcting the waste of water purchased from outside parties, as the cost of water purchased is generally higher than that of water pumped by company forces. Large reductions were made also in the consumption of company water. In order to keep a check upon the water purchased, all bills are entered on a card index for the purpose of comparing cost and consumption. Any increased consumption is noted and called to the attention of the officer having jurisdiction. If a satisfactory explanation cannot be given an investigation is made, which invariably results in disclosing and correcting the waste.
>
> Probably there are few water services on the average railroad where a saving cannot be effected. It is usually the smaller leaks at slop sinks, wash basins, toilets, urinals and other fixtures connected direct to sewers and drains that cause the greatest waste and are the most difficult to correct because of the apparent insignificance of the loss and hidden nature of the waste.
>
> As an example of the quantity of water that may be wasted through small openings, a $\frac{1}{8}$-in. stream, such as may be caused by a worn faucet washer, will, at 40-lb. pressure, waste 18,844 gal. per month, which at 20c. per 1,000 gal. will amount to $3.68, or enough to purchase a new faucet. A $\frac{1}{4}$-in. stream, such as may occur at an overflowing toilet flush, will waste 301,500 gal. per month at a cost of $60.30, or enough to install a first class toilet complete.
>
> It is not surprising that water waste occurs on the railways when we consider that the daily consumption is nearly 2,500,000,000 gal., delivered through innumerable connections and under the control of thousands of employees, the greatest number of whom have no conception of the value of water. It is a mistake to assume that the waste cannot be corrected or that correcting an occasional waste here and there solves the problem, as it is only by continued effort that maximum results are to be obtained.

The development of an adequate water supply and the economical and efficient design and construction of water stations, together with efficient supervision over maintenance and operation, are problems that require the undivided attention of a staff trained in water service work. The problems connected with water supply can best be solved with a separate organization charged with the sole responsibility for their successful operation.

Fire Protection for Seattle Oil Pier

SPECIAL precautions have been taken to prevent and combat fire at the Oil Dock, Pier A, Smith's Cove Terminal, at Seattle, Wash., which was described in *Engineering News-Record*, June 3, 1920, p. 1101.

A boom has been constructed of heavy Douglas fir logs, approximately 24 in. in diameter and installed so as to belt the waterside of the oil dock to retard the spread of burning oil in case of fire. Also three fire aprons reaching down below low tide and dividing the oil dock to two sections and separating it from the transit shed have been built for the same purpose.

On the top of the dock fillers have been placed under the bull-rail to form an oil-tight bulkhead along the face of the dock and a timber bulkhead has been built all around the south and north end as well as along the depressed tracks. This bulkhead is provided with hinged sections across the railroad tracks at the north and south end of the dock. Bags of sand have been provided for tightening these hinged sections of the bulkhead. All wooden structures on the oil dock have been sprayed inside with fire resisting paint, and wire screens have been provided to close all openings under oil tables, etc., where any danger from collection of débris is evident. Scale houses and other portable equipment showing evidence of fire hazard have been discarded and replaced with steel and iron construction. The boiler room, originally of frame construction, has been rebuilt of fire-resisting material (tile, concrete and steel frame), and automatic sprinkler systems have been installed in the boiler room and oil heating houses.

In addition to the fire-prevention measures an elaborate system of fire-protection equipment has been installed. This comprises three 40-gal. chemical engines located at the south center and north ends of dock and thirteen 2½-gal. chemical engines located approximately every 100 ft. along the depressed track. Also a great number of extinguishers and sand buckets are located in each of the oil bulking sheds.

In addition to the chemical engines there are hose carts containing 200 ft. of 2½-in. fire hose for connection to fire hydrants located approximately 200 ft. apart along the face of the dock and also along the roadway in the center of the pier. Fire-hose valves and hose reels containing 50 ft. each of 1½-in. fire hose are installed every 100 ft. along the depressed track side of the dock. There are about thirteen of these and they are located together with the 2½-gal. chemical engines which combination constitutes the one-man equipment.

In addition to the standard fire hydrants fire monitors are located along the center of the pier about 100 ft. apart. The monitors, being 30 ft. in height, would cover the full width of the oil dock in case of fire, in addition to protecting the steel dock and transit sheds by preventing the spread of fire.

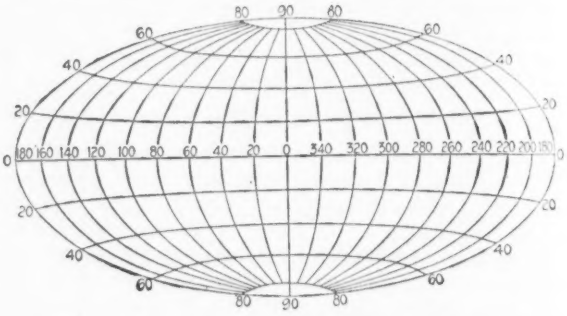
Additional auxiliary fire-alarm boxes have been installed down the center of the oil dock where they are readily reached from any part of the dock. Several watchmen clock stations are provided.

Equal-Area Projection of Sphere an Aid to Mapping

By R. L. Faris
Acting Superintendent, U. S. Coast and Geodetic Survey, Washington, D. C.

A PROJECTION of the whole sphere on an equivalent or equal area system devised by Aitoff, has just been issued by the U. S. Coast and Geodetic Survey, size 11 x 22 in. The sphere is represented within an ellipse with major axis twice the minor axis. No shoreline has been included since it is intended primarily for the plotting of the stars in astronomical work, its value for this kind of work being suggested by Prof. Benjamin Boss of the Dudley Observatory, Albany, New York.

The projection is bounded by an ellipse similar to that which is used in Mollweide's equal area projection



AITOFF'S EQUAL-AREA PROJECTION OF SPHERE

but, since the parallels are curved lines, the distortion in the polar regions is less in evidence. The net-work of meridians and parallels is obtained by the orthogonal or perpendicular projection of a Lambert meridional equal area hemisphere upon a plane making an angle of 60° to the plane of the original.

The fact that it is an equivalent or equal area projection combined with the fact that the celestial sphere is represented in one continuous map, will show at a glance the relative frequency of stars in the different regions of the expanse of the heavens. As constructed the radius of the sphere to be projected is taken as a decimeter so that the graticule has a very convenient size for general use.

As used for a map of the world, this projection is well adapted to replace the Mercator projection in atlases of physical geography or for statistical purposes and has the advantage over Mollweide's in that its representation of the shape of countries far east and west of the central meridian is not so distorted because meridians and parallels are not so oblique to one another. By employing the meridian of Greenwich as a central meridian, the continental masses can be mapped where the projection is at its best and the greater distortion transferred to the Pacific Ocean.

Sack Cleaning Machine Saves Money

In cleaning by machine 100,000 cement sacks on a concrete road job in Wisconsin 200 bbl. of cement were recovered. A bundle of 60 sacks, after cleaning, cleaning, thus reducing the freight charges on reweighed 25 lb., as compared with 50 to 75 lb. before turned sacks. Altogether the contractor estimated that he saved $1,000 on his cement sack account.

Pressure Filters at Lynchburg on Gravity Supply

Good Results Obtained from Well Equipped Plant—High Coagulant Tank—Spray Aerators Remove Tastes and Odors

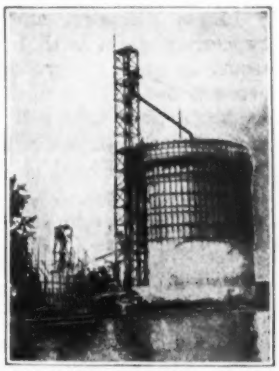
By Richard Messer, Chief Engineer, and A. S. Holway, Assistant Engineer, Virginia State Board of Health

PROBABLY the most completely equipped pressure filter plant in the country is located at Lynchburg, Va., a city of 35,000 population. It includes 12 cylindrical pressure filters having a total rated normal capacity of 6,000,000 gal. per day, and is giving satisfactory service according to present standards. Noteworthy features in the design and arrangement are a cylindrical coagulant tank 50 ft. in diameter and 60 ft. high, the application of alum and soda ash solution to the influent by pumping, rate controllers on filters and wash water line, many other automatic devices and an aerating system.

The supply is brought by gravity from the Pedlar River through a 30-in. gravity wood stave line, 23.2 miles in length. Until 1907, when the Pedlar system was completed, water had been taken without treatment from the James River. A concrete dam at the intake is 500 ft. in length, has a maximum height of 70 ft. and forms an impounding reservoir of 500,000,000 gal. The catchment area, estimated from a survey made by the U. S. Forest Service, is 33.2 sq.mi., on which there is a population of about 800 people. Of this area 1.33 sq.mi. is owned by the city, about 13 sq.mi. has been approved by the Forest Service for purchase and the remainder is divided into small tracts privately owned. When James H. Fuertes, consulting engineer, made his report on this project in 1903, it was the intention of the city to secure the entire catchment area.

Soon after completion it became apparent that the Pedlar supply was not all that was to be desired with regard to quality. During the winter and spring months the turbidity was often objectionably high, tastes and odors occurred during the summer, due to algae, and B. coli were found present at frequent intervals. Furthermore there was always the danger of a break in the single gravity main.

In 1913 liquid chlorine apparatus was installed at the intake as a temporary measure pending final recommendations by George W. Fuller. In his preliminary report of December, 1912, Mr. Fuller had recommended pressure filters, æration, additional storage in the city and a duplication of the gravity main at the river crossings. In his final report, three years later, he recommended that the pressure filter plant be located on College Hill, within the city; that æration should be provided at the Pedlar intake and after filtration; that pumping equipment be installed to deliver James River water to the filter plant in case of an emergency; that additional storage in the city be provided, and that metering of all services be undertaken. The improvements so far completed are in accordance with these recommendations, except for the new storage reservoir in the city and the ærator at the dam.

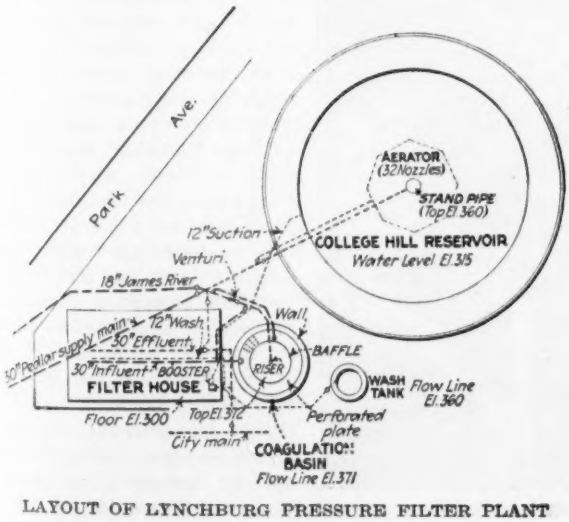


COAGULANT TANK 60 FT. HIGH UNDER CONSTRUCTION

In reaching a decision to adopt pressure filters, instead of the usual gravity filters, several factors due to local conditions had to be taken into consideration: (1) In order to provide for emergency use of James River water, the plant must be located in the city, the most favorable site being on College Hill. (2) This scheme was cheaper in first cost and annual expense than the alternative projects considered. (3) By using a deep cylindrical coagulation tank and pressure filters on College Hill, instead of the gravity filters, there is a saving in pumping costs of between $6,000 and $7,000 per year. To maintain the high service supply, water is delivered into the College Hill reservoir at El. 360. To provide sufficient head for operating the filters the top of the coagulation tank was fixed at El. 372, at which elevation the estimated carrying capacity of the 30-in. wood main is approximately 10,000,000 gal. daily. The physical features of the site are such that gravity filters would have to be built at a lower elevation than the College Hill reservoir, necessitating constant pumping. (4) The water as delivered at the plant is only slightly polluted. The turbidity seldom exceeds 100 p.p.m. and is usually under 30 parts.

The plant comprises: (1) A coagulation tank having a retention period of 3.4 hours; (2) 12 horizontal steel pressure filters 25 ft. long and 8 ft. in diameter; (3) a 65,000-gal. concrete wash water tank on a concrete tower, 29¾ ft. in height; (4) automatic chlorinators in duplicate; (5) an aerator in the reservoir.

Raw water, into which the chemicals have been pumped, is discharged at the top and center of the coagulation tank through a 30-in. riser, in which it has a travel of 150 ft. from the point of application of the coagulant to the discharge. The flow is then directed downward by a cylindrical baffle having a diameter of 34 ft. and extending to within 9 ft. of the bottom of the tank, which is flat. To secure an even distribution there is a horizontal perforated plate between the baffle and the outer shell, a few inches below the water level. The holes in this plate are



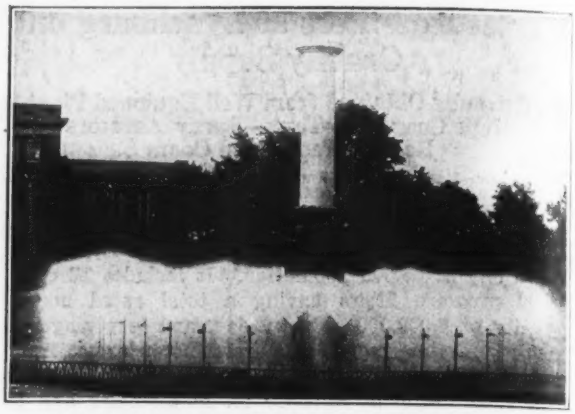
LAYOUT OF LYNCHBURG PRESSURE FILTER PLANT

3 in. in diameter, and the number can be varied by closing them with brick placed over the holes to secure an equal upward velocity in all parts of the tank between the baffle wall and the outer wall of the tank. A special pitot tube has been devised by the engineer in charge to register the difference between the velocity head and static head at each hole. In this way equal distribution is noted. If no "streaming" or short cuts take place the velocity under 100 per cent displacement would be 0.66 ft. per minute. The water from the coagulation tank is discharged through a 30 in. outlet, heading in the perforated plate. There are two overflow pipes, one within the other, with their tops 1 and 2 ft. respectively above the top of the perforated plate. By this means small overflows go back to the raw water supply pipe and large overflows go to the sewer. The tank is cleaned every four months.

Aluminum sulphate and soda ash are dissolved in concrete tanks, to which compressed air is admitted to agitate the solutions. The orifice boxes supply the solution feed pumps, of which there are two alum pumps, each with a capacity of 8 gal. per minute, two additional alum pumps, at 4 gal. per minute and two soda ash pumps at 4 gal. per minute. The 6 per cent chemical solutions are diluted at the pumps with filtered water about 1 to 8.

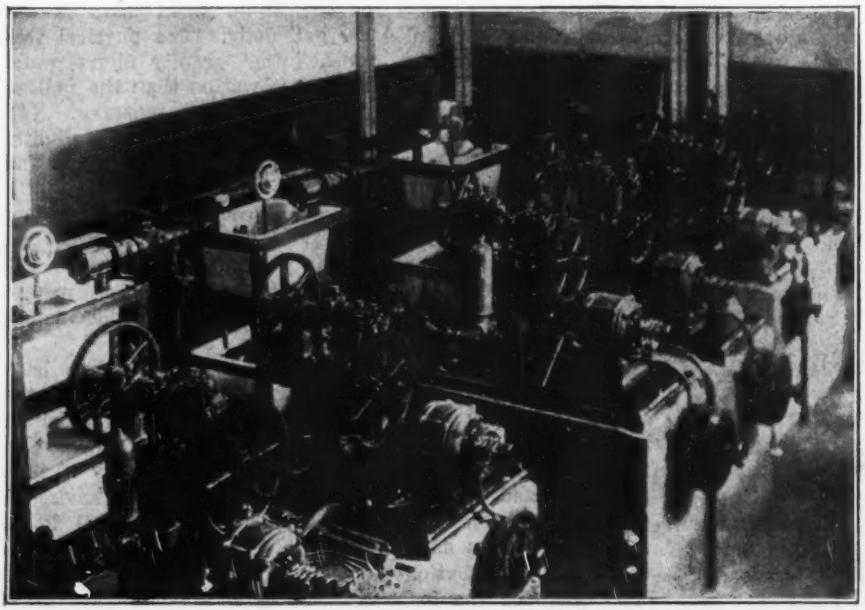
The average head in the filters is 65 ft. and the total operating head is 12 ft. Each unit is equipped with a rate controller of the Venturi type and a mercury gage which indicates the rate of flow through the filter. The filters are washed by air and water combined, through the same manifold and strainer systems. For the past six months air has been used irregularly about once a month. The rate is 540 cu.ft. of air at 5 lb. pressure being furnished by a rotary blower and wash water being drawn from a concrete tank filled by gravity from the filtered water main. Another rate controller of the venturi type regulates the rate of flow of wash water to the filter, usually 7½ gal. per square foot per minute.

After treatment with liquid chlorine the filtered water flows to the small standpipe in the center of the 4,000,000-gal. reservoir. When there is trouble due to tastes and odors from algae, the water is passed through an aerator consisting of 32 nozzles furnished by the Spray Engineering Co., arranged in a circle as shown in the photograph. The water is shot upward in a fine spray under 25 lb. pressure on the nozzles. The number of nozzles now in use is 24 for 9,000,000 gal. treated. Because of the large area of the reservoir the loss from the wind is small.



AERATOR WITH THIRTY-TWO SPRAY NOZZLES

To facilitate the control of the plant there is brought to one gage board the following: Two recording gages showing the height of solution in the alum tanks, two similar gages for soda ash; manometers connected to the 6-in. and 12-in. wash water controller; an indicating water level gage for College Hill reservoir; pressure gages for the effluent and influent lines, raw water line and booster pump discharge, and a recording water level gage for the wash tower. These gages, in conjunction with the indicating recording venturi meter on the raw water line, the gages on the individual filters and the samples taken in the laboratory, give the operator excellent information of how the plant is performing at all times.



SOLUTION ORIFICE BOXES AND PUMPS

Successful operation since June, 1919, has demonstrated that under special conditions pressure filters can be designed and equipped to give satisfactory results. It has been necessary to use chlorine only for short periods. The filtered water is consistently of zero turbidity and is almost colorless. It has been found that the alkalinity has practically no value in forming a coagulant with the aluminum sulphate and that a sufficient amount of soda ash to complete this reaction must be used at all times. The alum used varies from 0.35 to 1.25 grains per gallon. Although the growths of algae in the storage reservoir were not as luxuriant as usual during the summer of 1919

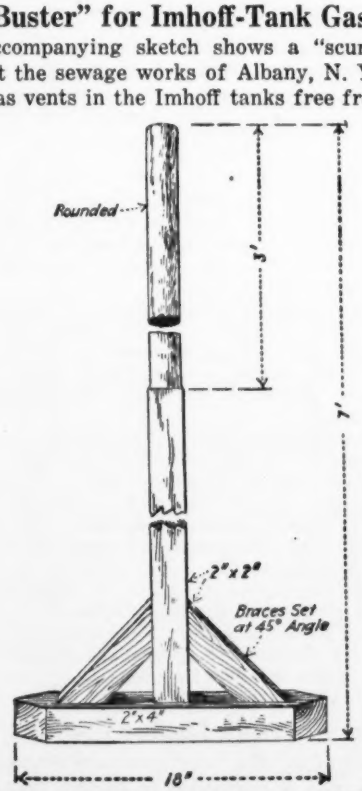
aeration removed whatever tastes and odors existed. It also reduced the free CO_2 from an average of 13 p.p.m. to 1½ parts, which is considered satisfactory. The decision as to the installation of the second aerator just below the Pedlar dam will depend largely on the effectiveness with which tastes and odors are removed by the present installation this summer.

The greatest operating difficulty is the one always experienced with pressure filters. Under conditions where it is difficult to secure satisfactory coagulation the operator has no means of noting the failure of the chemicals to react properly until the results are evidenced in the filtered water. It is planned to minimize this difficulty by constructing a suitable stairway to the top of the coagulation basin, which will make this point of observation easier of access.

The cost of the filter plant and the appurtenant piping was approximately $220,000. The main features of the design of the plant were in accordance with the recommendations of Mr. Fuller's report noted above. Harry L. Shaner, then city engineer, executed the detailed designs and supervised the construction in its initial stage. The work was completed under the supervision of his successor, C. L. DeMott. The filters were installed by the Roberts Filter Manufacturing Co. Since completion R. F. Wagner, assistant city engineer, has had immediate charge of the operation, while the bacteriological examinations are made in the office of Dr. Mosby G. Perrow, city health officer.

"Scum Buster" for Imhoff-Tank Gas Vents

THE accompanying sketch shows a "scum buster" used at the sewage works of Albany, N. Y., to help keep the gas vents in the Imhoff tanks free from sludge



"SCUM BUSTER" KEEPS IMHOFF-TANK VENTS FREE FROM SLUDGE OR SCUM

or scum. It is made from 2 x 2-in. and 2 x 4-in. timber, as shown. Joseph Murray is assistant engineer in charge of the Albany sewage works, under Frank R. Lanagan, city engineer.

Brick Laid on One-Inch Base Good After Four Years

No Defects Due to Weakness of Slab Are Apparent —Gravel Subsoil Contributed to Success

By Harlan H. Edwards
City Engineer, Danville, Ill.

FOUR years ago this summer 7 mi. of 9-ft. monolithic brick pavement was laid on a 1-in. concrete base in Stockton township, Iroquois County, Illinois. This pavement was a success from the start. The contractors made rapid progress, obtained a very smooth surface, and at the same time made a fair profit at a price of $8,500 per mile, with a 7-ft. earth shoulder on each side of the slab. At the present time the pavement has passed through practically four winters and there is not a defect except in the first section laid, where poor grouting has shattered the tops off a few bricks, and except at the ends of a concrete bridge, where a fresh fill settled and consequently took the pavement with it.

The construction of the Stockton township road was the outome of observations of an experimental monolithic brick road built in 1914 near Danville, Ill. This was one of the first experimental roads of monolithic brick to be constructed and it was described in the *Engineering Record*, Sept. 30, 1916, p. 400. Briefly four sections of 15-ft. pavement, crowned 1½ in., were built as follows: (1) A length of 36 ft., of 3-in. brick on a 3-in. base of 1:3½:6 concrete; (2) a length of 64 ft. of 4-in. brick laid longitudinally on a 2-in. base; (3) a length of 50 ft. of 4-in. brick laid transversely on a 2-in. base, and (4) a length of 48 ft. of 4-in. brick on a 1-in. base of 1:3½ cement-sand mixture.

In constructing these sections of pavement, the concrete was placed just as wet as was necessary for workability but not so wet that it would run at the edges. The slab was struck off with a templet but the concrete was not tamped and the brick were laid and grouted immediately. The road selected for the experiment carries a heavy traffic from coal mines. The fourth experimental section was placed where it received the most severe test, at the edge of a soft gravel road. In the spring, when the frost was breaking up, this gravel road was little better than a series of mud holes from which heavily laden coal wagons bumped up onto the pavement. In the summer, on the contrary, the gravel surface was high above the brick and the traffic dropped down upon the edge of the pavement. After four years of this punishment the slab showed no signs of failure. A new pavement was laid beyond the experimental sections, replacing the gravel road. Today, after six years of use, the experimental sections look as well as they did when built.

The experience with these test roads emphasizes the results obtained in actual service from the Stockton township road. A fact of importance to be kept in mind is that while the soils vary many times in character in the length of the pavement, under them all is a good bed of gravel. This gravel subsoil acts continuously as an efficient subsurface drain, performing good service at the most critical time when the thaw sets in and before the road surface and the ditches have thawed out.

At the prices of 1916, a saving of at least $3,000 a mile was effected by the construction described and

apparently a good pavement was secured. Many roads today could be paved with a corresponding saving in cost. While the monolithic form of brick pavement has now virtually been abandoned on account of construction difficulties, the principle of seeking the greatest economy consistent with safety still applies and more forcibly than ever. With prices of labor and material rising enormously it behooves engineers to spend a little more time on subgrade problems. Make the foundation strong and the slab will take care of itself.

Current Progress in Water-Wheel Design and Operation

Part of the Report of the Committee on Prime Movers presented to the National Electric Light Association at the convention at San Francisco, May 18-22, 1920.

THE increased size of water-wheels, together with the large number installed, seems to be the most important feature of the past year's development.

Single wheels of approximately 40,000 hp. capacity have been installed, and much larger ones are contemplated. The growth of operating systems makes feasible this increased size of individual units. One large manufacturing company reports that it has totalled nearly one-quarter of a million kw. in large hydro-electric generators (in units of over 1,200 kw. each) started in the past year. While all of the large water-wheel manufacturers report this tendency toward larger units, yet there are a large number of smaller vertical, direct-connected wheels being installed as additional or replacement units.

The higher efficiency obtained from these modern installations makes it profitable in a large number of cases to replace the old with the new. The large units are uniformly distributed over the United States. Many of the older hydraulic developments which used dams and canals, supplying many widely scattered individual water-wheels (necessary in the earlier days to distribute the power of the total fall in the river to the various manufacturing plants), are now planning a single hydro-electric station to utilize the entire fall and transmit the power electrically.

It is interesting to note that the tests of the large water-wheels in place show remarkably high efficiency. B. F. Groat, a consulting engineer of Pittsburgh, reports that "one of the most important things accomplished this past year was to prove that overall water power efficiencies approximating 90 per cent are an established fact reckoning from water to generator terminals."

Several large units have been started and continuously operated for over a year without a single shut-down on account of wheel troubles.

During the past year a new type of water-wheel has been developed by Forrest Nagler of the Allis-Chalmers Co. This is an exceptionally high-speed runner and was designed for low head plants.

The Great Western Power Co. of California has ordered from the Allis-Chalmers Co. four 15,000-hp. tangential wheels built for operating under an effective head of 1,008 ft. These wheels contain 21 buckets, each 36 in. wide and 24 in. deep, and water is supplied from thirteen nozzles. They are to operate one each overhung from the ends of a 22,200-kva. generator shaft running at a speed of 171.4 r.p.m. It may be of interest to state that several water-wheel manufacturers designed and recommended Francis type wheels for this head at a speed of either 600 r.p.m. or 750 r.p.m. The operating engineers, however, were afraid that the erosion on the clearance passages and gate mechanism might be rather severe when operating under a pressure of over 430 lb. per square inch. This, coupled with the fact that it would require a turbine type generator with smooth core field which was not suited for charging conditions on their long transmission line, led them to choose the impulse wheel.

On their impulse type plants, development has been along the central oil system for bearings, governors and relief-valve control, with combination pressure and governor-operated relief valve. These relief valves either discharge direct into the atmosphere or into other conical-shaped baffles, which consume the energy in the water. This point is often essential, as their mountain power houses are situated in narrow canyons where space is not available for allowing these high-pressure streams to escape unchecked.

The Pelton Water Wheel Co. is at present constructing some 800-ft. Francis wheels for the Southern California Edison Co. These machines are to be run 600 r.p.m. and deliver a maximum horsepower of 22,500.

Automatic hydro-electric plants are receiving considerable attention. Several plants of this type have been built or rebuilt and are working very satisfactorily. These plants operate without attendants, and the gate openings and output are regulated, according to the water supply available, by means of a float control from pond-level. These plants may be tied into a local power system or be run in connection with a steam station which takes care of the fluctuation of load and varying flow of stream.

In the last few years there has been a decided tendency to confine the power station building to the housing of generating apparatus and its control, locating step-up transformers and generally high-tension equipment outdoors. There is a more radical tendency, where climatic conditions are favorable, to carry this outdoor principle to the generating apparatus itself, housing only the control apparatus.

The Kingsbury and other forms of flexible thrust bearings for water-wheel units, have thoroughly established themselves and are generally giving good service. There has been a tendency in certain cases, with the use of spring-supported bearing, for vertical vibration of the shaft to occur. This appears only in rare cases, where there is sufficient hydraulic disturbance in the runner to cause movement. This has been overcome by blocking the springs in the bearings. The spring bearing also gives trouble with direct-connected shaft governor.

The Wellman Seaver Morgan Co. has produced an interesting improvement in the butterfly valve which practically eliminates the former difficulty of making it tight. The valve is provided with a cylindrical seat which, after the valve is closed, is brought up against the valve disk by differential hydrostatic pressure, producing a uniform water seat completely around the disk.

The Johnson type of valve continues to give satisfaction.

While there is a tendency in the larger units to make each unit self-contained and complete in itself with its own exciter, governor, pumps, etc., practice in general is divided between this tendency and that of centralizing the auxiliaries.

A very satisfactory solution of this problem is found by incorporating the best points of both systems so far as is possible. This is accomplished by having individual speed control sets for each of the main units and by having an emergency pipe connection from each individual set to each adjacent set. Each main oil pressure set is of sufficient size to operate two main units in an emergency.

This arrangement has the effect of making it possible to operate every unit in the power house from the governing system of its adjacent unit. Thus all of the advantages of the central oil pressure system are combined with the advantages of the individual system.

French Lumber Use

Notwithstanding the intensive care France gives to her forests, she is compelled to import from 30 to 40 per cent of the lumber she requires. Most French farmers get along with the identical buildings of their great grandfathers. The annual per capita consumption in France is not more than 100 board-feet per capita or less than one-third used by Americans.

Load Distribution Over Stringers of Highway Bridges

Iowa Tests on Three-Inch Plank Floors Indicate That Stringer Load Is Only About One-Half of Wheel Concentration

CAREFUL measurements of the distribution of load concentrations over the several stringers of a typical plank-surface highway-bridge floor, made at the Iowa Engineering Experiment Station, at Ames, supply new and valuable data bearing on the load capacity of ordinary highway bridges. A report on the tests has been made by T. R. Agg and C. S. Nichols, in Bulletin 53 of the station. The tests were made with the use of the strain gage, applied in very thorough manner; they covered a sufficient range of variable factors to give the results wide practical application; and at the same time the consistency of the several results among themselves demonstrates the value of the test method.

Plank floors on steel stringers were the special object of inquiry, because many bridges with floor of this type exist in country districts, and it is economically necessary to maintain them in service as long as possible under tractor and motor-truck traffic. Calculation of safe load capacity requires knowledge of how a wheel concentration is distributed to the various stringers. It was therefore aimed to determine by the tests (1) what percentage of the wheel load is carried by a single I-beam or channel stringer and what percentage is distributed by the planking to the other stringers; (2) whether two layers of planking have greater distributing effect than a single thickness; (3) whether the distributing effect is greater or less when the planks are loose from the nailing pieces; (4) whether there is much change in load distribution as the diagonal cleats of a traction-engine wheel come into different positions of bearing.

All tests were made on a floor 16 ft. wide, of 3-in. plank laid transversely on longitudinal I-beams and channels spanning 18 ft. The stringers ranged from 6-in. I-beams, spaced 12 in., to 9-in. I-beams spaced 27½ in. When the effect of a double floor was under

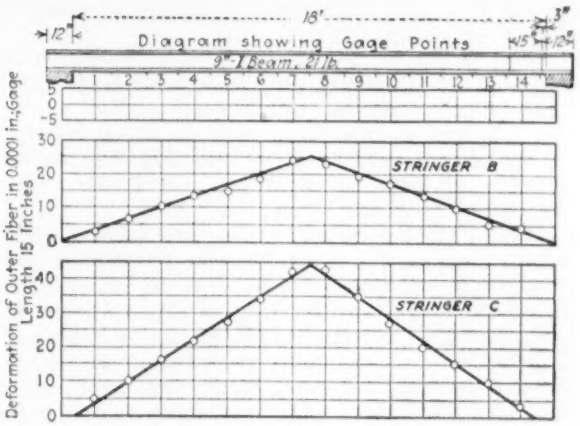


Diagram showing Gage Points
9" I Beam, 21 lb.
STRINGER B
STRINGER C
Deformation of Outer Fiber in 0.0001 in. Gage Length 15 Inches

FIG. 1. MOMENT CURVES FOR TWO ADJACENT STRINGERS, ONE DIRECTLY UNDER WHEEL

study, a course of 2-in. plank was laid over the 3-in. plank, the upper course being in some cases longitudinal and in some cases diagonal. Loads were applied by a pair of 80-in. wheels 2 ft. wide, spaced 6 ft. c. to c., loaded by hydraulic jacks bearing against a set of reaction girders above the test platform. The bottom flange of every stringer was laid out in a continuous series of gage lengths for a 15-in. Berry strain gage, and under each test load all the gage lengths were measured.

Briefly, the results of the tests were:

The greatest load concentration on a single stringer was equal to 55% of one wheel load; i.e. 45% or more was distributed through the planking. The distributing effect was slightly improved (the concentration decreased) by adding a second layer of plank laid lengthwise. The distribution was not so good when the ends of the planks were loose as when they were firmly spiked down.

When one of the wheels approached the side of the bridge floor, the share of load borne by the outer stringer increased rapidly from practically zero to nearly as much as the maximum that same on any other stringer. Therefore, say the authors, it appears

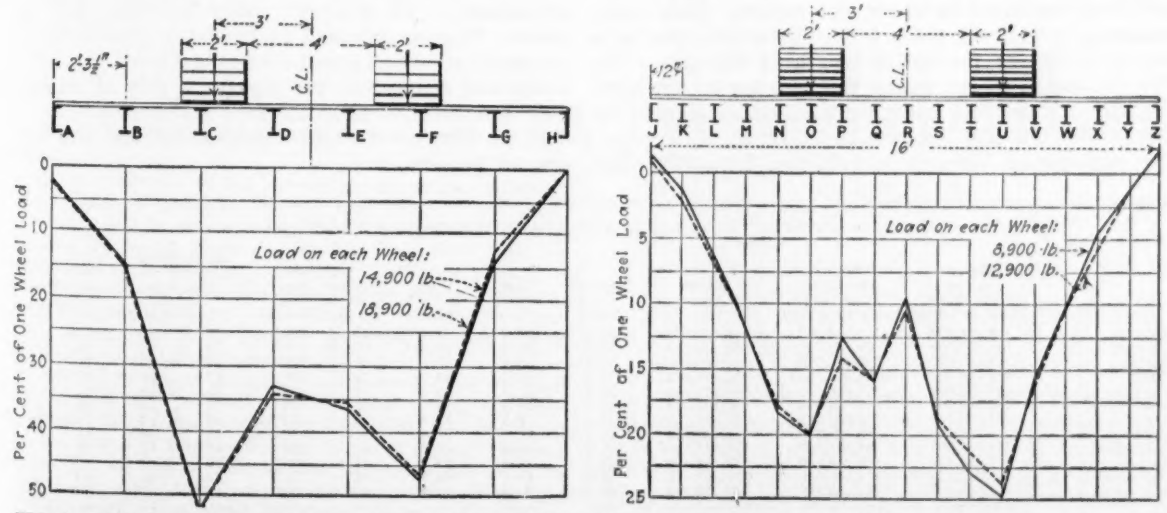


FIG. 2. DISTRIBUTION OF CONCENTRATED LOADS LATERALLY TO THE VARIOUS STRINGERS OF THE FLOOR

At left, floor of six 9 x 21-lb. I-beams and two 9 x 13¼-lb. channels, floored with 3 x 12 transverse plank fastened to nailing strips on channels. At right, floor of seventeen 6 x 12¼-lb. I-beams, floored with 3 x 12 transverse planks fastened to nailing strips on outer stringers.

advisable to make the outer stringer just as strong as any other stringer.

With shallow stringers closely spaced, the distributing effect of the floor plank was found to be greater than with deeper stringers widely spaced. The authors conclude that shallow joists "may be safely employed if enough are used to insure wheel bearing on two joists." It is to be noted that the wheels in the test were 2 ft. wide.

Illustrating the nature of the test results, Fig. 1 herewith shows the moment curves for two adjacent stringers in one of the tests (six 9-in. I-beam stringers, two 9-in. channel stringers). The points marked are the plots of the deformations in successive strain-gage lengths, and thus are direct measures of the moment along a stringer; the lower of the two curves refers to a stringer under a wheel, the upper and adjoining stringer. For all stringers the moment curves were of the same triangular outline, indicating that the unloaded as well as the loaded stringers can be considered to carry a concentrated load.

In Fig. 2 are reproduced two of the plots representing load distribution transverse of the floor. They are by no means the most regular of the various sets of curves obtained in the different tests. However, as will be seen, they give a direct comparison of load distribution with wide and close spacing of stringers.

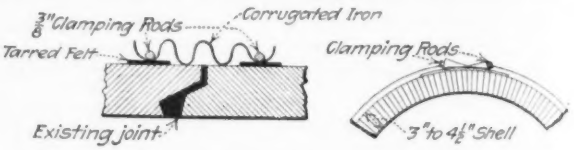
Heavy Leakage from 42-in. Concrete Pipe on Sooke Pipe Line

Pipe Not Covered — Few Expansion Joints — Leakage Records Given — Joints Being Reinforced

THERE has been heavy leakage for several years through joints of the concrete pipe line bringing water from Sooke Lake to Humpback reservoir for the city of Victoria, B. C. When this line was built in 1913 a few expansion joints were put in near the end of the line but their use was soon discontinued, the idea being to let cracks develop where they would and then to give them such treatment as seemed necessary. However, contraction and expansion resulted in slight but continued movement in every pipe section. This cause leakage at practically every joint, which amounted to a serious total for the entire length of the line. No effective means of preventing this loss has as yet been applied. A tabulation bringing the leakage data up to date, which has just been completed by F. M. Preston, city engineer of Victoria, is published herewith. Details of design and construction are given in *Engineering Record*, Oct. 2, 1915, p. 406.

The conduit is 27½ miles long and consists of 42-in. lock-joint pipe, 3 in. thick, precast in 4-ft. sections. Except for the siphons, the pipe is laid on hydraulic grade and without backfill. Due to the rough country traversed a great part of the line is on curve. The concrete itself, which was cured by a steaming process, is proving highly satisfactory, the leakage occuring only at joints. When the pipe was first put in service there was practically no leakage. During the first season's operation, however, the leakage appeared and since that time has responded to weather conditions very closely, as shown in the table.

The worst conditions obtained in December, 1919, when almost the entire flow was lost by leakage for a period of six days and the conduit was choked with broken ice when the thaw set in. If the pipe could have been kept full it is thought that this difficulty would not have occurred. As it was, ice about 6 in. thick formed inside the pipe and, when the temperature rose, this ice thawed and came away from the pipe in long pieces which were broken by passing through the siphons and which finally formed an ice jam in the pipe. With the pipe blocked, practically the usual quantity of water continued to enter it at the intake and was practically all lost through leakage. This leakage did not all occur at open joints as at this time two of the washout valves had been cracked by the frost.



DETAIL OF JOINT REINFORCEMENT
The width of the corrugated iron will be governed by commercial sizes of sheets

Several expedients that have been tried for checking the leakage have been unsuccessful. For example, silt has been shoveled into the manholes to see if the joints would not at least temporarily silt up. Particularly troublesome joints have been patched with concrete periodically. No adequate relief has thus far been found. Experiments will be tried this year with corrugated iron strips placed circumferentially around the joints and clamped to the pipe by a pair of clamping rods, as shown in the accompanying illustration.

F. M. Preston is water commissioner and city engineer of Victoria, B. C.

TABULATION OF LEAKAGE DATA, SOOKE LAKE AQUEDUCT, VICTORIA, B. C.

	Water Leaving Sooke Lake Total for All Months	Water Arriving at Humpback 1915 to 1919	Water Lost Gal.	Per Cent Loss Total	Loss in 1916 per Cent	Loss in 1919 per Cent	Max. per Cent Loss on Any Day in Any Month		Mean Temp. on Day of Max. Loss Deg. F. Air	Mean Temp. on Day of Max. Loss Deg. F. Water	Mean Temp for Months Deg. F. Air	Mean Temp for Months Deg. F. Water
January	334,541,300	165,500,000	169,041,300	50.6	58.9	54.5	78	1919	35	39	30	39
February	133,250,000	74,700,000	58,550,000	43.8	40.0	44.3	60	1919	33	40	33	38
March	279,166,600	158,000,000	121,166,600	43.4	64.8	50.0	60	1919	41	43	36	40
April	482,916,600	291,500,000	191,416,600	39.8	50.3	42.7	68	1917	42	41	47	48
May	649,625,000	479,800,000	169,825,000	26.1	17.2	33.5	57	1918	50	56	52	54
June	774,000,000	666,900,000	107,100,000	13.9	10.3	15.9	37	1919	52	58	57	61
July	782,658,100	687,800,000	94,858,100	12.1	4.8	15.4	28	1919	58	64	59	67
August	764,666,600	648,500,000	116,166,600	15.2	11.1	17.4	33	1918	58	66	62	68
September	733,749,900	601,900,000	131,849,900	18.0	17.4	23.0	40	1919	47	62	57	64
October	777,358,400	605,210,000	172,148,400	22.2	29.9	39.5	81	1919	30	50	47	55
November	521,062,500	313,500,000	207,562,500	39.8	41.1	48.2	69	1915	39	48	40	47
December	411,500,000	162,000,000	249,500,000	60.6	39.4	76.0	91*	1920	19	35	36	40
Totals	6,644,495,000	4,855,310,000	1,789,185,000	Av., 26.9	....	....	..	....	..	..	..	..

* Temperature dropped to 10 deg.

British Engineers Interested in Concrete Consistency

Paper Proposes Measure of Optimum Water Content But Does Not Suggest Practical Workability Limit

APPRECIATION of the role of consistency in concrete strength is becoming evident in British technical literature, although they seem not to have progressed as far in the study as in this country. A recent paper entitled "The Consistency of Portland Cement, Mortar, and Concrete," by H. G. Lloyd, read before the Concrete Institute, is the first indication of an interest in the subject. This paper proposes a method whereby can be determined the precise amount of water required for the chemical or physical hardening of mortar or concrete. The method fails for practical application in that there is no measure suggested for the variations from this optimum amount that are necessary, the author admits, for practical workability.

The author states that it is well established that every portland cement requires a definite quantity of water in order that it may set perfectly. He goes further and states that a mortar or concrete to set requires the amount of water necessary for the cement setting plus just enough water to dampen the surfaces of the fine and the coarse aggregate. It is on the asumption that each ingredient in a mortar or concrete should be supplied with its requisite amount of water that the attempt is made in the paper to determine the quantity of water required by portland cement mortar or concrete. This method consists in determining the optimum amount of water, first for the cement, second, for the fine aggregate, and, third, for the coarse aggregate, a proper mathematical average of the three being the optimum water content for a perfect setting of the concrete.

The proper amount of water for the cement is measured, according to the author, by its consistency, and that consistency may be measured by either the Boulogne method or the Vicat apparatus. The Boulogne method is a visual observation of the behavior of a neat cement mortar pat. The Vicat test, as is well known in this country, is a needle test on a cement mortar pat. With either of these tests the optimum amount of water for the cement alone may be found.

The method of finding the proper amount for a mortar is described in the following words in the paper:

> In order to arrive at the percentage by weight of water necessary to be added to the portland cement and sand, it is customary to mix the dry materials and then to add a weight of water known to be less than the requisite amount and so to continue adding further small quantities until the physical characteristics of the mortar indicate the desired consistency.
>
> This object may be attained by a simpler method if it is approached in a different manner. Suppose that a test on a sample of portland cement is to be made in accordance with the standard portland cement specifications, and that eventually the sample complies with all the requirements. Suppose also it is known that the portland cement requires 22 per cent of water. The mortar briquettes are about to be made in the proportion of three parts by weight of standard sand to one part by weight of portland cement. What quantity of water must be added to the dry materials in order to obtain what may be called "standard" consistency for this particular cement and sand? If the ingredients are considered separately it will be seen that since the quantity of water required by the cement is known, it only remains to find out how much is required by the sand, in order that it may have the surface of each grain covered by a thin film of water. In other words, the sand needs damping so that it may not take the water for this purpose from the portland cement.
>
> The quantity of water required to damp the sand can be ascertained easily in the following manner: Weigh out half a pound of dry, standard sand; immerse it in clean water in a small bowl; stir it well and allow to stand; then pour off the superfluous water and empty the sand onto a clean cloth and wring out the cloth with the sand in it; screw the cloth up by the four corners and whirl it at arm's length until only occasional drops are thrown off. Pour the sand onto a sheet of plate glass; then with a small trowel push the sand to one side of the glass. Mop up the water on the glass, push back the sand with the trowel, and repeat the process to and fro, mopping the glass each time, while keeping the sand well mixed, until no pools of water remain on the glass and the glass is only just uniformly damp. Weigh out a convenient quantity of the sand, dry it thoroughly and weigh it again; the difference in weight will be that required to damp the known weight of dry sand. The percentage weight can then be calculated. Suppose that it is 4 per cent of the weight of the dry sand. The total weight of water to produce the sand to consistency may then be calculated as follows:
>
> 1 lb. of portland cement at 22 per cent ..... = 0.220 lb. of water
> 3 lb. of standard sand at 4 per cent ..... = 0.120 " " "
> 4 lb. of dry materials require 0.340 " " "
>
> i. e., the dry materials require 0.340/4 of 100 = 8.5 per cent of water to produce a standard consistency.
>
> This may be reduced to a rational formula and thereby the necessity for doing a physical test to obtain the consistency of the cement mortar may be avoided.
>
> In order to obtain the standard consistency for any proportions of concrete composed of portland cement, sand, and coarse aggregate the same principle may be adopted as in the case of mortar. The quantity of water required to damp the stone may be obtained experimentally in exactly the same way as that described for sand. Then the following formula will apply:

$$w = \frac{Cc + Ss + Gg}{C + S + G}$$

where w = percentage of water by weight required by the combined weight of portland cement and sand
C = the number of parts by weight of dry portland cement.
c = percentage of water by weight required by the portland cement.
S = the number of parts by weight of dry sand.
s = the percentage of water by weight required by the sand.
G = the number of parts by weight of coarse aggregate.
g = the percentage of water by weight required to damp the coarse aggregate.

These figures give what may be considered the optimum amount of water, but the author recognizes that the consistency thus secured is not necessarily the most workable consistency for different kinds of work, for he says: "With the information thus obtained the consistency of the mortar could be agreed upon for various classes of work and the volume of

water for each mixing." He further states without explanation that neat portland cement suitable for pointing brickwork requires a + 16 per cent consistency. Portland cement mortar suitable for facing work requires a + 23 per cent consistency; for brick backing, 33 per cent; and that a 1:2:2 gravel concrete, with the gravel passing a ¾-in. square mesh and retained on a ¼-in. square mesh requires a + 60 per cent consistency. This is "suitable for foundations and all positions where a consistency which will enable the concrete to fill cavities and envelop large stones or projections from heavy castings."

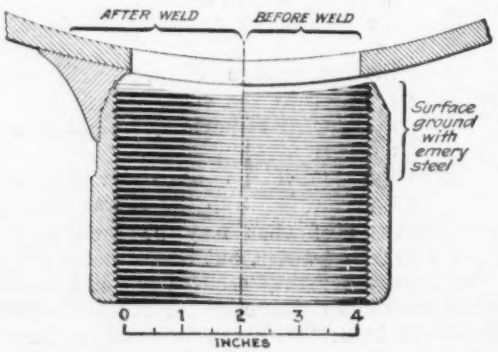
The author finally states: "In this paper an attempt has been made to eliminate differences in mortars and cements due to differences of consistency. In fact a method has been described for determining a standard consistency and also for prescribing on a rational basis one which is greater or less than the standard consistency. It should therefore afford a practical method for men working in different parts of the country (with the same cement, but with different aggregates) to obtain comparable results so far as consistency is concerned, so that briefly a means is afforded by the use of these rational formulas to compare (1) the relative strength of mortars and concretes made up of various proportions of the same materials, and (2) the relative strength of mortars and concretes made up of the same cement but with different aggregates in any desired proportions."

Arc Welding Outfit Used Before Tapping Steel Water Pipe

Coupling Welded to Main By Portable Outfit So Tapping Machine May Be Used on Irrigation Mains Fed By Los Angeles Aqueduct

A PORTABLE electric welding outfit mounted on a motor-truck is now used exclusively for tapping services into the large irrigation mains fed by the Los Angeles aqeduct in the San Fernando Valley. A standard pipe coupling, the size of the desired service, is welded to the main, a valve attached and the main then tapped through the valve by means of the usual tapping machine, without shutting off the water.

The mains supplying Los Angeles aqeduct water to the San Fernando Valley for irrigation purposes range up to 72 in. in diameter and the heads vary from 50 to 500 ft. To avoid the disadvantages of having to tap into the main lines, some of the large trunks were paralleled by smaller pipe-lines to which the services



COUPLING WELDED TO STEEL WATER MAIN

WELDING 4-IN. COUPLING TO STEEL WATER MAIN

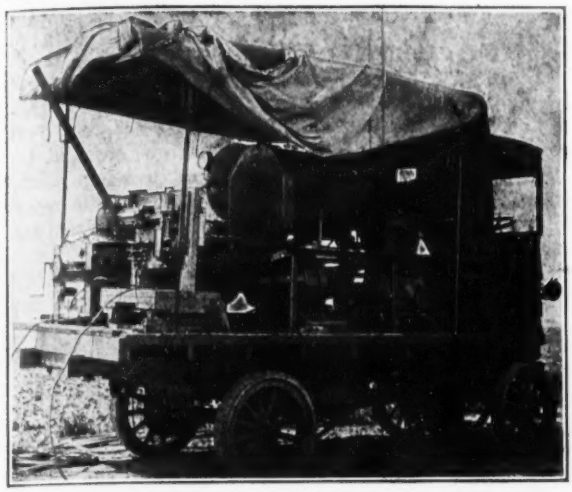
were attached. Where this was not done, and services had to be tapped into the main itself, there was always a considerable loss of water incidental to emptying perhaps two or three miles of mains. The usual practice, therefore, was to wait until orders were received for several services, then the main was emptied and all these connections installed at the same time. Where there were already a great many services on the line to be emptied, care had to be taken to avoid serious inconvenience to consumers. Thus there was often considerable delay and possibly the loss of a crop before new applicants could be served.

Under the new system when a service order is received a portable electric welding outfit is taken to the job on its own wheels, and about four hours after the work starts the connection is completed and ready for the meter setters. After considerable experience with this method the water department reports that there is no difficulty in making the joints water tight and of ample strength, and that there is a marked saving in both labor and material.

The procedure is to take a standard pipe coupling of the size desired and turn it in a lathe or grind it with an emery wheel to give a bright surface all around for about 2 in. from its end. The end is beveled to an angle of about 60 degrees and if the main to which it is to be attached is of small diameter the beveled end of the coupling is ground so that the space between the main and the bottom of the beveled cut will not exceed ⅛ in. at any point.

Before the welding is commenced the surface of the main where the service is to be attached is first ground with an emery wheel so that the bond can be made on polished metal. The coupling is then stuck to the main by spot-welding in several places, after which the first layer of metal is applied. Considerable skill is required in handling the electric arc until the first layer of metal is deposited. Successive layers can be placed with less difficulty. The danger in careless or inexperienced work on this first layer is that holes may be burned in the pipe. When the weld is completed a reducer and plug is screwed into the coupling and after filling the latter with soap and water the air-hose is attached and 100 lb. pressure is applied to test the weld for leaks.

The welding equipment, in the form of a complete and compact unit, is mounted on a 1½-ton motor-truck. The main parts are a 6-cylinder gasoline engine which



ARC WELDING OUTFIT USED BEFORE TAPPING WATER MAINS

drives a D.C. generator and an air compressor. This gasoline engine, which is entirely separate from the engine of the truck itself, is belt-connected to both the generator and the compressor. It is equipped with a very sensitive governor to give accurate voltage control. The panel on which switches and controls are mounted is built up on a small platform supported on wheels so that it can be taken to any desired part of the work, thereby reducing the number of attendants which the plant requires. The air-compressor delivers to a receiver from which air lines are lead to the tools used for grinding, chipping, calking, etc. An air pressure of about 100 lb. per square inch is ordinarily used for this work.

The outfit was developed by S. Barton Brown, an electrical engineer of Los Angeles, to meet the need of the city water department in making San Fernando service connections. The foregoing information was supplied by H. A. Van Norman, assistant engineer of the Department of Public Service of the City of Los Angeles.

Kansas City Engineers Study Traffic

To help solve acute local traffic and rapid transit problems the Kansas City Engineers Club organized a traffic and transit committee which is now in its second year. To assist its investigations it has a number of subcommittees, covering such matters as traffic census, handling less-than-carload freight, time contour map, inner belt trafficway, automobile licenses, effect of height of buildings on street congestion, one-way traffic streets, etc. In October, 1919, a comprehensive census was made of traffic in the business district. Plan for a comprehensive system of one-way traffic streets in this district have been worked out in order to give immediate relief to the congestion, pending the widening of streets to form an inner belt trafficway entirely surrounding the district. Recommendations have been made also to regrade and repave certain streets in order to attract traffic to them. It is not the intention to do engineering work that should be done by the city's departments, but rather to act the part of good citizens in pointing out lines of development and also to show the value of the engineer to the community.

Notes from Foreign Fields

ENGINEERING CENTER OF THE BRITISH EMPIRE

BY

E. J. Mehren

EDITOR ENGINEERING NEWS-RECORD

THE engineering center of the United States, we all concede, is on Thirty-ninth Street, near Fifth Ave., New York City. There, in one building, we have the homes of all the great engineering societies of the country.

In England—yes, in the British Empire—the engineering center is equally well defined although the headquarters are not under a single roof. With few exceptions, though, they are to be found in a relatively small area—within a few blocks (a most indefinite term in London) of Westminster Abbey, the Houses of Parliament and the Government offices. The center of the group, of course, is the imposing home of the Institution of Civil Engineers on Great George Street, while nearly all of the other societies have their offices in Victoria Street, which joins Great George Street at Westminster Abbey.

If I have rightly sensed the attitude of English engineers, there will be no disagreement with the statement that the home of the civil engineers is the center of the engineering life of the British Empire. The Institution, comparable in its field to our own society of civil engineers, is by all odds the most influential of the engineering societies of the United Kingdom. That position is due to its greater age, to the distinguished character of its membership through a full century of existence, to the excellent quality of its work and to its steadfast adherence to the very highest ideals in society activity. Moreover, to a greater extent than with our own society of civil engineers, it has among its members engineers who follow specialties other than those covered by the restricted use of the term civil engineering. Dr. Tudsbery, the secretary, said that no count had been made, but that he would venture the estimate that one-third of the membership was following other specialties.

The home of the Institution of Mechanical Engineers is the next building down the street from that of the civil engineers. The building of the Institution of Electrical Engineers is not in this locality, but that is the only engineering society of importance, so far as I learned that has strayed from this centre.

In Victoria Street are to be found the offices of the institutions of automobile, gas, heating and ventilating, mining, municipal and county, sanitary, and water engineers. The Institute of Metals is here, too, as is also the Society of Engineers. These are but a few of the societies which have their offices in this neighborhood.

Here, too, have gathered the offices of engineers. One can go into entry after entry on Victoria street and find the names of engineers predominating on the directory boards—many of the names internationally famous.

Civil Engineers' Home—The home of the Institution of Civil Engineers is a building to be proud of. The accompanying halftone, though made from a rendered drawing, gives an excellent view of the building. However, a very small building, the leashold on which has not expired, stands just where the group of statuary is seen at the corner. With the exception of this small portion, the structure is completed.

The area is about 22,700 sq.ft. On the ground floor are two large reading rooms and a number of offices, including that of the secretary. A grand staircase leads to the second floor, where are to be found the main library, an impressive oak-finished room 28.5 ft. wide and 158 ft. long; the Great Hall, 45 ft. wide and 100 ft. long, rising three full stories a height of 45 ft.; and a lecture theater, with tiered seats, accommodating several hundred. On the top floor are another library room, the museum and offices.

LONDON HEADQUARTERS OF THE INSTITUTION OF CIVIL ENGINEERS

The finish throughout is in harmony with the spaciousness and proportions of the various rooms and halls. The corridors, staircases and rotunda—running up through the full height of the building and surmounted by a dome—are in gray marble, the Great Hall in plaster panels between pilasters of marble with bronze bases and capitals, the reading rooms and library in either oak or walnut.

All in all the impression the building makes is that of the home of a solid, prosperous, dignified organization—and in so doing it truthfully represents the great Institution that it houses, and forms a fitting centre for the engineering interests of the British Empire.

We in the United States can rightly share in the professional pride that springs from the traditions, strength and influence of the Institution. Surely, our English friends freely include us in their professional kinship. I was fortunate in having as my guide through the building Sir Maurice Fitzmaurice, C. M. G., F. R. S., past-president of the Institution. Mr. Tudsbery, being absent on my first visit, could not be with us. Sir Maurice referred with unrepressed pride to the fact that Alfred Noble had been an honorary member of the Institution. Upon Mr. Noble's death General Goethals was elected an honorary member in his place.

Thus does the great Institution officially testify to its feeling of kinship to American engineers.

London, May 11, 1920.

Removal of Taste Producing Protozoa from Illinois Reservoirs

WASTES and odors in the water supply of Mt. Vernon and Danville, Lll., during the past year were investigated by Dr. Edward Bartow, chief of the Illinois State Water Survey, and were traced to microorganisms (mostly protozea). Treatment of the reservoirs with copper sulphate eliminated the oganisms and restored the palatability of the water.

Complaints at Mt. Vernon began early in January, 1920. Microscopical examination showed that the reservoir water contained synura, dinobryon and uroglena. The first of these gives the odor of ripe cucumbers, with a bitter or acrid after taste; the others give fishy odors. The water was treated with copper sulphate at the rate of 2½ lb. per 1,000,000 gal. About 10 lb. at a time was placed in a canvas bag towed behind a boat. A larger charge might have given uneven distribution owing to rapid dissolution of the sulphate. In about a week the water was usable.

At Danville the water supply is taken from two impounding reservoirs, 4 miles apart. In a severe drought in 1919 the lower reservoir was drawn down 5 ft. and then maintained at that level by water from the upper reservoir. Complaints of taste and odor began in August. Inspection showed patches of green and brick-red scum in both reservoirs, but not near the dams. Even where there was no scum the water had a reddish tint.

The microscope showed several organisms which had not been found by similar examination in 1916 and 1917, while euglena showed a great increase over former years and was visible as a brick red scum. Anabena, uroglena and peridinium were in abundance. All of these organisms produce oily or fishy tastes. Treatment of the lower reservoir with 1½ lb. of copper sulphate per 1,000,000 gal., distributed as described above, had no effect. A second application was made, with 8 lb. per 1,000,000 gal., and water flowing from the upper reservoir was treated with 5 lb. per 1,000,000 gal. by discharging a solution from a barrel through a calibrated faucet. Treatment at both places continued from Oct. 2 to Oct. 9. On Oct. 4 all suckers were found dead for a distance of about half a mile below the upper dam, but none were found below the lower dam. Tastes and odors began to disappear Oct. 7 and in a few days the water had returned to normal condition. Rainfalls on Oct. 5 and 9 may have been a factor in bringing about the improvement.

Teach Fire Prevention in Schools

The study of fire prevention has been added to the curriculum of the New York public schools. Fire prevention has been a compulsory course for some time in Kentucky. New Jersey has a law, recently passed, which provides for the teaching of fire prevention.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

The Review of "Retaining Walls"

Sir:—I have read with much pleasure and profit Mr. Godfrey's review of my book on Retaining Walls. Several of his criticisms call for some explanation from the author.

The devotion of a considerable portion of space to "artist stuff" is demanded by the edicts of economy and good construction. In the light of present-day prices, it seems unjustifiable to mix up expensive materials with an efficiency of only ten to 50 per cent when modern research has shown the way to obtain much higher efficiencies. The reviewer does scant justice to the host of investigators who are doing much to raise the standard of concrete mixing and proportioning. "Cement and thorough mixing" alone, will not produce the desired results. N. C. Johnson, a hard-headed and practical investigator, has shown this quite fully.

The question of nomenclature is always an irritating one. In spite of an implied indifference or carelessness in the use of the same symbol, much attention was devoted to the construction of a good working symbolism. Generally, the manufacture of a textbook does not justify the use of many fonts of type or the use of other alphabets than the English. Several of the important characters, such as *K*, *J*, etc., were kept distinct throughout the text. (The letter *g* is quite obviously defined on p. 47). In quoting other authors, their nomenclature has been preserved. In treating reinforced concrete, the recommended letters of the special committee on concrete of the American Society of Civil Engineers were used. A little study of the several uses of the same letter will show that confusion is hardly probable except in the most cursory of readings. The same letter never appears twice in the one expression and although, in one figure, the letter x is used twice, the text is very clear on the separate definitions. A table defining the several symbols is always annoying, at least to me. I feel as though I am in duty bound to memorize such a legend, and brain fag results before the text has been started.

The question of rain is fully covered, I feel, in the treatment of saturated soils and drainage. Frost is much of a bug-a-boo. Too often it is made the scapegoat for a poor design or foundation. I have omitted its consideration, because what I would say would, or could, leaves but little that is constructive in the reader's mind.

If Mr. Godfrey will reflect what proportion of all walls built were revetment walls, fifty to seventy-five years ago, and what proportion at the present time, he will agree that the wall is more of historic than present interest. However, a theoretical treatment of this type has been given in the text.

I approach the subject of counterfort walls with much diffidence and anxiety. I certainly did not want to give a dogmatic treatment of the theory (in spite of Mr. Godfrey's implication). I emphasized throughout the discussion of this wall, the difficulties and in fact the absurdity of laying down a hard and fast treatment. This is impossible. But a continuous and simple design is essential, and this is all that the text attempts. I certainly will not take issue with Mr. Godfrey as to what is the correct design of a counterfort. If he will furnish me with a good, simple design, continuous and easy to follow, I will use his method as cheerfully as the one outlined in the book.

I hardly think that the wall shown in Fig. 51, page 111, is as close to incipient failure as Mr. Godfrey thinks it is. Probably all standard concrete design can be libelled for the same defects as he would point out in the wall shown.

GEORGE PAASWELL.

New York City.

For the Structural Draftsman

REVIEWED BY R. FLEMING

American Bridge Co., New York City

STRUCTURAL DRAFTING AND THE DESIGN OF DETAILS—By Carlton Thomas Bishop, C. E., Assistant Professor of Structural Engineering, Sheffield Scientific School of Yale University, etc. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 10 x 8 in.; pp. 352; illustrated. $5.

The structural draftsman is coming into his own. Not only is he in greater demand and at a larger salary than ever before, but a literature is being created for his benefit. The latest and most comprehensive of the books written for his special needs is the one under review.

The 44 chapters of the book are divided into three parts. Part I, of 4 chapters, is Introductory, taking up notation and definitions, the organization of a structural steel company, the manufacture and the fabrication of structural steel. Evidently much thought has been given to the notation adopted but the reviewer takes exception to the terms "pound-feet" and "pound-inches" being used instead of "foot-pounds" and "inch-pounds" for expressing moments. Any theoretical advantage is more than offset by the further confusion it would cause in the present chaotic state of engineering symbols. The definitions of engineering terms, filling 12 pages, are clear and concise.

Part II, of 25 chapters, is devoted to structural drafting proper. What may be called the mechanical features of drafting are considered at length. A chapter is given to inking and tracing, another to erasing and another to drawing directly in ink on tracing cloth. After disposing of preliminaries common to all drawings, single chapters are given to beams, plate girders, latticed girders, roof trusses, bridge trusses, columns, bracing systems and miscellaneous framing. Then follow chapters on erection plans and diagrams, material order bills, shop bills and shipping bills, miscellaneous drawings and lists, and checking and correcting drawings.

The choice of material entering into a treatise like Part II depends largely upon the personal equation of the writer. The reviewer would condense the chapters on ordering and billing and would add a chapter on drafting room errors—their classification, cause and cure. Chapter XIV, "Clearance and Erection

Considerations," is unusually good but the importance of the subject warrants a more extended treatment. Incidentally, riveted joints have often been used for bridge spans of more than 200 ft. (p. 120). The B. & O. R. R. is now building a 434-ft. double track bridge over the Allegheny River near Pittsburgh, in which riveted joints are used throughout.

Part III, entitled "The Design of Details," begins with a chapter on shear and bending moment and is followed by chapters on the design of beams, of tension and compression members, and of plate girders. Riveting has four chapters. Cover plates, web stiffeners, splices, pins, reinforcing plates, bearing plates and column bases, and grillage beams have each a chapter.

The author holds himself well within his subject and does not trespass upon the field belonging distinctively to the designer of the structure itself. Before a draftsman can detail beam and girder connections intelligently he should understand the principles of shear and bending moment so well presented in Chapter XXX. The chapter on tension and compression members is good but a page on angle clips at ends of members could profitably be added. (While examining the chapter the reviewer was interrupted to look at the detail of an angle that emphasized the author's subheading: "The least net section is not necessarily a right section.")

An occasional statement in the chapters on plate girders and riveting should be modified. Thus, p. 219, "Full-sized holes cannot be punched satisfactorily in metal thicker than ¾ in.," is not strictly true. If the thickness of the plate does not exceed the diameter of the hole it can be punched without difficulty. Again, p. 266, "It is impracticable to use more than one web thickness in any girder," does not hold for heavy girder work. The Cunard Building, New York City, now being erected, has a number of girders in which the web is made of two plates each ¾-in. thick.

Following Part III are 36 pages of tables and diagrams. A valuable feature of the table, "Properties of Wooden Rectangular Beams," is that the section moduli are shown not only for nominal dimensions in even inches but also for dimensions which conform to the actual sizes of planed and sawed lumber.

The 169 figures of the book are well drawn and are easily understood. An inherent difficulty in the making of any book on structural design or drafting is the matter of illustrations. While principles remain the same, types of construction and details are constantly changing. Bethlehem columns or plate and angle columns are taking the place of the "Typical Office-Building Columns," Fig. 133, composed of channels and plates. With the present high price and scarcity of labor the tendency is to fewer pieces and simpler details. The "Typical Drawing for a Roof Truss," Fig. 116, shows a truss that today is not "typical." The top chord on each side of the peak would be divided into 4 instead of 5 parts and designed to resist cross bending. The slight increase in the weight of steel is more than compensated by the handling of fewer pieces in shop fabrication. Another saving of labor is the elimination of unnecessary cuts in plates and angles. The gusset plates shown in many of the figures would be made rectangular. Diagonal cuts in angles would be avoided, especially where the angles are embedded in fireproofing as in Fig. 145. Nothing is said about rolled steel slabs though they are largely used in place of cast-iron bases, as shown in Fig. 291; also for the bases of columns as illustrated in Fig. 135, where wing plates and considerable riveting would thus be avoided. On the whole the author well covers his field.

Some features of the book are worthy of special mention. The "Synopsis" at the beginning of each chapter gives in a few lines a statement of the contents of the chapter. Each figure bears the same number as the page upon which it is shown, thus facilitating easy reference. The author in his footnotes is generous in giving references to other books where the subject under consideration may be found treated more fully. Thus, "A copy of Smoley's 'Parallel Tables of Logarithms and Squares,' McGraw-Hill Book Co., Inc., New York, should be included in the equipment of every structural draftsman." Again, "For other angles see Conklin's 'Structural Steel Drafting,' John Wiley Sons, Inc., New York; Turner's articles in Vol. 43 of *Engineering News;* or Dannenberg's diagrams in the *Engineering Record*, Feb. 17, 1912." Ketchum's "Structural Engineers' Handbook" is referred to 18 times.

The reviewer heartily agrees with the author in his insistence that formulas and tables should not be used until their underlying principles are understood.

To the student or inexperienced draftsman the book is invaluable. He cannot afford to be without it. In addition to a clear and comprehensive presentation of the subject he will find notes of warning that if observed will save him from many a pitfall. The experienced draftsman can hardly fail to add to his efficiency by reading it. There is not a dull chapter in the book and he will find the restatement of that with which he is familiar to be interesting.

The typography of the book is all that needs be desired. This, with the general excellence of the contents, will make it a standard in the field of structural drafting for some time to come.

Highway Construction in California

CALIFORNIA HIGHWAYS: A Descriptive Record of Road Development by the State and by Such Counties as Have Paved Highways—By Ben Blow, Manager Good Roads Bureau, California State Automobile Association. San Francisco, Cal.: H. S. Crocker Co. Cloth; 6 x 9 in.; pp. 308; illustrated. $6.

The record of accomplishment by which California has set a fast pace in highway construction is presented in a comprehensive way in Ben Blow's "California Highways." This is the first attempt to present between the covers of a single book the general outlines of the scope of plans and accomplishments of the state and individual counties in highway construction. Mr. Blow has long been an indefatigable worker for improved highways and has personally conducted the campaign for bond issues in so many parts of the state that he is conceded to be one of the best, if not the best, authority on the California highway situation in general.

The first part of the volume outlines the history of the movement for good roads in California, including bond issues; histories of the first bureau of highways and the present highway commission, and their organization and personnel; the use of convict labor; types of road construction; and road maintenance; with a discussion of road loads, safety designing, tree planting and camp sites. The second section deals with the seven

highway divisions into which the state is divided, and includes a discussion of state highway routes. A third section in 27 chapters is devoted to what the author calls "California's good road counties" and takes up in detail the road situation in each. The numerous one- and two-page maps give the reader a very clear idea of road locations in each section. The large state map inserted in the back cover shows the proposed and completed trunk lines and identifies pavement types, and the excellent halftones with which the book is illustrated constitute in themselves a record of road construction from the Oregon line to the Mexican border.

A Thoroughgoing Committee Report

THE DETERIORATION OF STRUCTURES OF TIMBER, METAL AND CONCRETE EXPOSED TO THE ACTION OF SEA-WATER. First Report of the Committee of The Institution of Civil Engineers—Edited by P. M. Crosthwaite, B.A.I., M. Inst. C.E., Secretary to the Committee and Gilbert R. Redgrave, Assoc. Inst. C. E. London, Eng.: H. M. Stationary Office Imperial House, Kingsway. Cloth; 6 x 10 in.; pp. 301. illustrated. 30s.

When the Institution of Civil Engineers sets about investigating anything it does it with true British thoroughness. The execution may be somewhat slow and ponderous but the results are there for those who seek them. All of these characteristics are shown in the first report of the Institute's committee "appointed to investigate the deterioration of structures of timber, metal and concrete exposed to the action of sea-water." For a preliminary report it is distressingly long and the various abstracts and rehashes of the fundmental records are too much like the interminable endorsements on an army document, but the subject of sea-water deterioration is covered in admirable fashion.

The committee has followed the empiric method in its first report. Called on to investigate the behavior of structures in sea-water—a subject of vital interest to the British—its initial step was to find out how such structures had behaved in the many British harbors the world over. Apparently the committee made no effort to get information on any any non-British structure, though the Institution has members and correspondents in all countries. This neglect of foreign sources has probably not seriously detracted from the report except possibly in the case of sea-water concrete, which has been studied so much more extensively in the United States than elsewhere. Certainly the report is not complete without some reference to those studies.

At any rate, the list of reports is geographically imposing. The British Isles are covered, of course, but Africa, Australia, New Zealand, India and the Middle East, China and the Far East and America (Halifax and Jamaica) all contribute their share. Ports not heard of in this country and so obscure as to require a search in the atlas are called upon for experiences. The effects of the omnipresent teredo and the corrosive sea salts are traced throughout the Seven Seas—where those seas wash British shores. The result is a collection of data without parallel. For the engineer who wants to go back to fundamentals and does not choose to accept another man's deductions this series of local reports is invaluable.

In addition to these reports there are some conventional, though adequate, papers on timber, marine borers and iron corrosion, and some abstracts of the literature of the subject of sea-water deterioration, which is inadequate because it takes up only papers presented to the Institution. A real bibliography of the subject would reveal much more information than the committee is aparently aware of. Finally there are a series of abstracts of the various local reports, which are valuable for the casual reader who does not care to study them in detail. The real value of the report, however, lies in the detail of structural behavior in the many waters of the world.

The committee is also conducting a number of experiments and studies, the details of which are not announced, which are to be made the subject of a later report.

Chronicled in Germany in Three Languages

COPIES of the first two issues of a new monthly, published separately in German, English and Spanish, with "Engineering Progress" as the title of the English edition, have been received. The new journal is published under the auspices of the *Verein Deutscher Ingenieure*, the *Verein Deutscher Eisenhüttenleute*, and the *Verband Deutscher Elektrotechniker*, with C. Matschoss, Berlin, Germany, as editor (annual subscription, $4 or 18 shillings; sample free on request from Auslandverlag G. M. B. H., Berlin S. W. 19, Krausenstrasse 38-39). Articles in various fields of engineering are included, besides short book notices and miscellaneous notes. The salutatory follows:

After years of sanguinary struggle, engineering seems best fitted to bridge the gap between conflicting interests and to tie afresh the broken bonds. Humanity will be thrown back for generations unless man concentrates all his intellect, all his physical strength upon the one problem: to creat new values. Never yet was mankind afforded greater opportunities for work. The task is gigantic, and the success would be equally so if the conception of a community of interests were developed and strengthened throughout the world. Hearken to the voice of our age! Look ahead! Work! Have faith in the future, in the solidarity of work! Don't fight one another—help each other!

For over five years enormous values have been destroyed, and nothing but powder and shot has been produced. Many factories have been razed to the ground and in those that continued to produce, the wear and tear of the machinery has been such as to make a speedy renewal an imperative necessity. The reconstruction of the devastated stretches of country in Europe requires enormous quantities of goods. Even before work on a large scale has begun, the general craving for goods is such that it can only be satisfied to an insignificant extent. The introduction of the standard eight-hour day all over the world will naturally mean a proportionately reduced production, for the time being.

It will be the duty of all nations, therefore, to produce more than ever before. No longer need we worry to find a market for the product of our work. The care whence to procure the necessaries of life must be met by an increased production, the science of engineering must assist us in this task.

The development of the engineering industry of a country is determined to a considerable degree by its resources. The raw material possessed in abundance by the sparsely populated country is refined by the craftsmanship of the workers in crowded districts. Thus the tendrils run from one people to another, furthering the idea of the uniformity of all human aims and ambitions. The manufacturer, the engineer, the merchant, the overseer, and the worker, all must help. They must rebuild the world entirely; they are to make it a new, a better, and a more comfortable world than the one that has gone to wreck, and when we speak of their work in these columns we shall remember the words of Carlyle: "The true Epic of our time is not Arms and the Man but Tools and the man—an infinitely wider kind of Epic."

The foregoing ideas have led to the publication of this paper the object of which is to give a true record of the latest and greatest achievements in the wide field covered by the various engineering industries. It is published in the German, English, and Spanish languages, under the auspices of the three leading German engineering institutions: The Verein Deutscher Ingenieure—the Verein Deutscher Eisenhüttenleute—the Verband Deutscher Elektrotechniker. It will be the endeavor of the editors appointed by these institutions to achieve the objects outlined above in a sober and impartial manner. "Engineering Progress" is to be a new link in the chain of great international engineering publications, appearing in the different languages, and all aiming at the realization of the same universal ideal.

A Lost Opportunity in Authorship

OPPORTUNITIES IN ENGINEERING—By Charles M. Horton. New York and London: Harper & Brothers. Cloth; 5 x 8 in.; pp. 90. $1.

It is no easy task to present, in the form of a short popular essay, the opportunities afforded by a given profession, or business or industry. Such an essay should show insight, be interesting and should convince without misleading. This volume may serve from the viewpoint of popular interest but few engineers of education, experience and good judgment would consider that it had a full measure of the other two essentials. The author's viewpoint seems to be confined too much to mechanical engineering, and that in a rather narrow and commercial field, to reflect a broad conception of engineering either as a profession or as an opportunity for service.

PUBLICATIONS RECEIVED

AMERICA'S GREATEST DAM: Wilson Dam, Nitrate Plant No. 2, Muscle Shoals, Alabama—By William Benjamin West, B.S., Associate, American Institute of Electrical Engineers. Cambridge, Mass.: The Author, Mass. Institute of Technology. Paper; 9 x 6 in.; pp. 64; illustrated. $1.

SEWAGE TREATMENT EXPERIMENTS AT BROOKLYN, N. Y.: A Brief Review of Five Years' Work—By George T. Hammond, M. Am. Soc. C. E., Engineer in Charge of Experiments and of Sewer Design, Brooklyn, N. Y., etc. Reprinted from the Proceedings of the American Society for Municipal Improvements, 1919. Brooklyn, N. Y.: The Author, 156 Berkeley Place. Paper; 6 x 9 in.; pp. 103; illustrated.

CANADIAN DEPARTMENT OF RAILWAYS AND CANALS: Report, 1918-1919—Ottawa, Can.: The Department. Paper; 7 x 10 in.; pp. 75.

COAST EROSION PROTECTION WORKS ON THE CASE SYSTEM IN BRITISH GUIANA—By Gerald O. Case, Associate Member of the American Society of Civil Engineers, Associate Member of the Engineering Institute of Canada, Vice-President of the Tidal Engineering Corporation. New York: The Author. Paper; 6 x 9 in.; pp. 63; illustrated.
Description of elaborate reclamation and protection work carried out by the author.

DIE BERECHNUNG DER WARMWASSERHEIZUNGEN: Zweite Auflage Nach dem Tode des Verfassers resorght von Professor Dr. Georg Recknagel. Korresp. Mitglied der Bayerischen Akademie der Wissenschaften zu Munchen. Berlin, Germany: Druck und Verlag von R. Oldenbourg. Paper; 9 x 13 in.; pp. 110; illustrated. 25 M.
A treatise on the calculation of hot-water heating systems.

DRAINAGE ENGINEERING—By Daniel William Murphy, A. B., A. M., Ph.D., Consulting Engineer, M. Am. Soc. C. E., Former Drainage Engineer, United States Reclamation Service. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 178; illustrated. $2.50.

ELECTRIC DRIVEN WATER WORKS IN INDIANA: The Application of Electric Motive Power to Small Waterworks Plants—By D. D. Ewing, Professor of Electrical Railway Engineering, and G. C. Blalock, Instructor in Railway Engineering. Lafayette, Ind.: Director of Engineering Experiment Station, Purdue University. Paper; 6 x 9 in.; pp. 100; illustrated.
A more general discussion of electric-driven pumps than the word "Indiana" in the title would indicate. There is bibliography and a summary of pump tests.

EMPLOYMENT STANDARDIZATION IN THE PUBLIC SERVICE—By William C. Beyer, Assistant Director, Bureau of Municipal Research. Supplement to the National Municipal Review, June, 1920. Philadelphia, Pa.; National Municipal League. Paper; 7 x 10 in.; pp. 12.

ENGINEERING FOR LAND DRAINAGE: A Manual for the Reclamation of Lands Injured by Water—By Charles Gleason Elliott, C.E., M. Am. Soc. C. E., Consulting Drainage Engineer, etc. Third Edition, Revised. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5 x 8 in.; pp. 363; illustrated. $2.50.
Earlier editions were noticed in this section of *Engineering News*, March 19, 1903, and August 15, 1912. The author specifies these changes in the present edition: "The discussion of the hydraulics of flow in underdrains has been rewritten, and new tables for the discharge of tile drains have been introduced which, it is believed, correspond quite closely to results obtained in practice. A diagram to facilitate the application of Kutter's formula in the design of ditches and canals has been added, as well as historical drainage matter, and a more complete text on drainage by pumps and on the drainage of irrigated lands."

GOVERNMENT CONTROL OVER PRICES—By Paul Willard Garrett; Assisted by Isador Lubin and Stella Stewart (History of Prices During the War), Wesley C. Mitchell, Editor in Chief. Washington, D. C.: War Industries Board. Paper; 6 x 9 in.; pp. 833; illustrated.

HIGHWAYS OF MINNESOTA: Report of the Commissioner, 1918-19—St. Paul, Minn.: The Commissioner. Paper; 6 x 9 in.; pp. 40.

LOUISIANA BOARD OF STATE ENGINEERS: Report to His Excellency, Ruffin G. Pleasant, Governor of Louisiana, April, 1918-20—New Orleans, La.: The Board. Paper; 6 x 9 in.; pp. 157.

THE MOVEMENT FOR THE REORGANIZATION OF STATE ADMINISTRATION—By Charles Grove Haines, Professor of Government. Austin, Texas: The University of Texas. Paper; 6 x 9 in.; pp. 80; illustrated.

NEW JERSEY DEPARTMENT OF HEALTH: Report, 1919—Trenton, N. J.: The Department. Cloth; 6 x 9 in.; pp. 440; illustrated.

NEW YORK STATE TAXATION AND RETRENCHMENT: Report of the Special Joint Committee—Albany, N. Y.: Special Joint Committee on Taxation and Retrenchment. Paper; 6 x 9 in.; pp. 153; illustrated.
Deals with cities and counties but chiefly with cities. Summarizes results of hearings at which many officials gave their opinions.

NON-TECHNICAL CHATS ON IRON AND STEEL—By LaVerne W. Spring, A.B., Chief Chemist and Metallurgist, Crane Co., Chicago. New York: Frederick A. Stokes Co. Cloth; 5 x 8 in.; pp. 358; illustrated. $3.50.

THE PEAT RESOURCES OF IRELAND: A Lecture Given Before the Royal Dublin Society by Professor Pierce F. Purcell, Assoc. M. Inst. C. E. London: Department of Scientific and Industrial Research. Paper; 7 x 10 in.; pp. 25; illustrated. 9d.
Contains enough general matter to appeal to most engineers and publicists who are giving attention to the possible utilization of peat for fuel. A foreword by George Beilby, director of the Fuel Research Board mentioned above, is not very optimistic as to peat utilization on a large scale, but praises the lecture and urges the need for study of the engineering problems of peat utilization.

PERFORATED CASING AND SCREEN PIPE IN OIL WELLS—By E. W. Wagy. Washigton, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 48; illustrated. 20c. From Superintendent of Documents.

PIEUX ET SONNETS—Par Edouard Nos et Louis Troch. Ingenieurs. Paris: Gauthier-Villars et Cie. Paper; 7 x 10 in.; pp. 348; illustrated.
The latest French work on piles, pile-drivers and piledriving. A much more elaborate treatise than is available in English, particularly in the mathematical study of the bearing power of piles.

THE PORT OF NEW YORK—By Thomas E. Rush, Surveyor of the Port. New York: Doubleday, Page & Co. Cloth; 6 x 9 in.; pp. 361; illustrated. $3.50.

PRICE LEVELS IN RELATION TO VALUE: Presented Before the Fortieth Annual Meeting of The American Society of Mechanical Engineers—By Cecil F. Elmes, Chicago Manager, Sanderson & Porter. Chicago, Ill.: Sanderson & Porter. Paper; 9 x 11 in.; pp. 25; illustrated.

SEVEN CENTURIES OF BRASS MAKING: A Brief History of the Ancient Art of Brass Making and Its Early (and even recent) Method of Production.—Contrasted with that of the Electric Furnace Process—A Twentieth Century Achievement—Bridgeport, Conn.: Bridegport Brass Co. Paper; 8 x 11 in.; pp. 78; illustrated.
A good example of the trade catalogue that consists mostly of historical and technical matter relating to an industrial art.

SHANGHAI MUNICIPAL COUNCIL: Report and Budget, 1919-20—Shanghai, China: The Council. Paper; 8 x 13 in.; pp. 453; illustrated.
A large variety of public works and other city activities are reviewed in this handsomely made volume.

SOME OBSERVATIONS ON TYPHOID FEVER IN IOWA—By Max Levine and H. E. Middleton. Reprinted from the Journal of the Iowa State Medical Society, Feb., 1918. Ames, Iowa: Iowa College of Agriculture and Mechanic Arts. Paper; 6 x 9 in.; pp. 14; illustrated.

STATE AND TERRITORIAL HEALTH OFFICERS' PROCEEDINGS, 1919 CONFERENCE—Washington, D. C.: U. S. Public Health Service. Paper; 6 x 9 in.; pp. 110.

WHAT WILL METRIC STANDARDIZATION COST?—San Francisco, Calif.: World Trade Club. Paper; 4 x 9 in.; pp. 147; illustrated. 50c.

ZONING—By Edward M. Bassett of the New York Bar, Counsel of Zoning Committee of the City of New York, Former Chairman of Districting Commission of the City of New York. Supplement to the National Municipal Review, May, 1920. Philadelphia, Pa.: National Municipal League. Paper; 7 x 10 in.; pp. 36.
An authoritative review of the subject, followed by a useful bibliography, the latter prepared by Theodore Kimball of the Harvard School of Landscape Architecture.

LETTERS TO THE EDITOR

Spanish Novelist's Reference to the Engineer Is Resented

Sir—Judging from the articles by V. Blasco Ibañez, now running in the daily press, the civil engineer, as in many parts of this country, is not held in very high esteem in Mexico. Note the reference to Bonillas, a one-time candidate for president: "Later, he studied engineering in the Massachusetts Institute of Technology. His record as a fighting man, however, was not brilliant. He even failed to become a general. He merely served as an *engineer*, marching in the rear of the revolutionary army with the obscure civilians, who looked after the administrative affairs of the regime."

Again: "The defects of the *engineer*, Bonillas"; "What the *engineer*, Bonillas lacks"; and "The obscure Mexican-American *engineer*, converted by the revolution into a diplomatic agent."

Had it not been for engineering talent like that of A. A. Robinson, Rudolph Fink, Howard Schuyler, Andrew Talcott, Sigismund Low and other well-known engineers, Señor Ibañez would not be touring Mexico in luxurious and palatial Pullmans, but instead "hoofing it" or traveling astride of that well-known transportation agency, the Mexican burro.

EMILE LOW.

Buffalo, N. Y.

More About Leaky Cross-Connections

Sir—I note in your issue for May 13, p. 939, an editorial entitled "Leaky Cross-Connection Kills Fifteen." The story is an obvious one which he who runs may read. But there must be more ways than one by which contaminations are inadvertently made. I once saw a blueprint tank, on a top floor of a building, into which water from a hose, attached to a faucet, was continually running *except* when people drew water on the lower floors. This caused the blueprint water to suck back into the pipe system, and those who drank water below were getting a mixture for whatever it was worth. I am not aware that anybody was injured by it, but I presume that there are tanks installed on top stories backing and filling with far worse liquids than blueprint water.

G. W. LEE.

Brookline, Mass.

Sir—I have read with much interest your recent editorial on leaky cross-connections. You may be interested to know that the Minnesota State Board of Health felt that the question of cross-connections was such a menace to the health of the people of the State that the following regulation prohibiting such connections was passed on Oct. 8, 1918: "There shall be no physical connection between water supply systems that are safe for domestic use and those that are unsafe for domestic use."

Immediately following the passage of this regulation, an active campaign was started to eliminate these connections throughout the State. You can imagine the protests that arose from the interests affected. We were accused of being unreasonable, unfair and many other things, but we have vigorously enforced this regulation and most of the connections have now been eliminated. Minneapolis has reported that all such connections have been severed, and St. Paul informs us that they are now ready to make such a statement. Duluth is actively engaged in eliminating connections there and we are informed that the work will soon be completed. The work in the smaller cities and villages of the States is completed so far as our investigations have extended.

It is very gratifying to us to see such an article appear in the pages of your journal; it assures us that the positive stand we have taken on this problem is correct.

I am enclosing a copy of a reprint [from Public Health Reports] on an epidemic of dysentery in South St. Paul in 1914 which involved the use of a cross-connection. At least one other small epidemic has occurred in the State from such connections.

H. A. WHITTAKER,
Director, Division of Sanitation.

Minnesota State Board of Health, St. Paul.

[The leaflet mentioned by Mr. Whittaker may doubtless be secured by those interested by sending a 2c. stamp to the Minnesota State Board of Health, St. Paul, Minn.—EDITOR.]

Shall Chinese Labor Be Imported?

Sir—I note a letter in the issue of *Engineering News-Record* for June 3, p. 1121, signed by John Ericson, M.Am. Soc.C.E., which contains the following sentence: "A similar letter was sent to every member and associate member of the American Society of Civil Engineers, about 2,000 in all."

This statement is in error, as the total corporate membership of the American Society of Civil Engineers, which includes members and associate members, was 8,852 on May 25, 1920—the total membership of the society being 9,525 at that time.

Inasmuch as the figures given by Mr. Ericson to indicate the results of his questionnaire upon the subject of importation of Chinese labor might be very misleading if taken to indicate the relative proportion of the members of the American Society of Civil Engineers who either favor or oppose his proposal, I hope you will publish the foregoing figures.

H. S. CROCKER,
Acting Secretary, American Society of Civil Engineers.

New York City.

Sir—To say that I was surprised at reading the communication of John Ericson in your issue of May 6 is stating it mildly. That an engineer and good citizen of Mr. Ericson's standing should advocate such a thing as admitting Chinese laborers to the United States to relieve the labor situation is almost unbelievable. To my mind it shows that even the best men in this country fail to grasp the cause, much less the true remedy, for our serious labor shortage, for did they do so they would never give up hope of redeeming this country in the right way instead of further degrading it by surrendering to the yellow peril.

All we need to do in this country to relieve the labor shortage is to repeal the prohibition amendment to the Federal Constitution, or at least to so amend it as to permit the use of wine and beer as beverages by the working class. The 18th amendment has not prohibited the capitalist class from using liquor, because their cellars were filled before prohibition became effective, nor has it affected the middle class, because they have permanent homes, in which they can ferment their own wine and brew their own beer. With the common laborer it is entirely different, for "the pick and the shovel and the wheelbarrow man" seldom has a permanent place to live, where he can set up a home brewery or winery, and is therefore the only one being deprived of liquor.

It is not only the foreign born, but also large numbers of native born laborers in this country who resent this discrimination, as they do not earn enough to purchase the high priced commodities of bootleggers and moonshiners, however numerous these may be, or how plenty their wares. For this reason they have been leaving this country ever since prohibition became effective, particularly since the Volstead Act put the ban on even 2.75 per cent war beer.

Before prohibition, even during the war period, we had plenty of Italian, Swiss, Greek, Slavonian and other common and farm labor in most parts of California, but they have now left here for foreign countries and are still going. Also large numbers of American born laborers have left for Canada, Cuba and South America on account of prohibition. I have personally kept track of over 200 such laborers, who have known me for many years and worked on different construction jobs on which I have been consulting engineer, and nine-tenths of them have left this country on account of prohibition, while the remaining one-tenth are talking about doing so. Many of those who returned to their native countries, not finding conditions favorable there, have written to me saying they are going to South America rather than to return to a "dry" United States. We are now re-

duced to depend almost entirely upon Japanese and the lowest class of Mexican cholos for our common labor, for even the better class of Mexican laborers left here in large numbers upon the advent of prohibition.

If we have lost all hope of redeeming the United States by repealing or modifying the present prohibition laws and their enforcement, it may be fitting to admit the Chinese as our equals, because they come from a country where prohibition was first adopted, 459 B. C., and has been enforced so long that the Chinese Empire has lost its power and the people have degenerated through the use of drugs and narcotics taken as substitutes for vinous, malt and spirituous stimulants. But I sincerely trust that we will not have to degenerate to the condition of China and the other old prohibition countries in the world, but will remove prohibition before it is too late.

F. C. FINKLE,
Consulting Engineer.

Los Angeles.

Mr. Luten's Attorney Takes Exception

Sir—In *Engineering News-Record*, Feb. 26, 1920, p. 417, you quoted the opinion of the Circuit Court of Appeals for the Eighth Circuit in the case of Luten vs. Wilson Reinforced Concrete Co. The opinion does Mr. Luten and his business an injustice.

With the exception of the Turner and Norcross patents in the field of flat-slab construction the courts never before had an opportunity to consider reinforced-concrete patents upon a record that offered any full history of the art. In the Wilson case Mr. Luten and the State of Nebraska, cooperated in making a record that showed the history of the entire art, and especially as related to reinforced-concrete bridges. This was done by the plaintiff in the hope that the court would consider the subject broadly and give an opinion on the case before it, that would be a guide in the future as to how far devices for effective reinforcement of concrete are patentable.

The opinion shows that this hope was not realized. The opinion is to the effect that Mr. Luten has been guilty of fraudulent methods in promoting the use of his patents and in procuring the payment of royalty thereunder and that because of this fraud, the patents are invalid.

In the preparation of the case both parties devoted themselves to the art, and gave scant consideration to the matter of exploiting the patents. The attorney for the defendant asked that all circulars and advertising matter of the plaintiff be produced, and this was done without reservation, and without any explanation or testimony regarding them. The attorney for the defendants built up a false structure on the basis of these circulars, and the District Judges adopted his theory. The attorney then had the opinion printed and I have no doubt he sent the copy to you for publication. This is fully as reprehensible as the publication of favorable opinions by Mr. Luten.

Aside from the validity of his patents, Mr. Luten has made substantial contributions to the art of reinforced-concrete design and construction. This fact was recognized by the Circuit Court of Appeals in the case of Luten vs. Whittier, where it was said:

> Plaintiff is evidently an intelligent and skillful bridge engineer, designer and builder. His work has doubtless contributed greatly to the reinforced-concrete bridge-building art, and he is entitled to great credit therefor. His success in that art is perhaps due in part to the invention in suit, but it seems to us not improbably due in larger part to his personal efficiency and perhaps to other claims of the patent in suit not here involved, as well possibly to numerous other patents which he has taken out.

Mr. Luten's profits come from friendly users, and not from royalty collected by suits or by blackmail. The reference in his circulars to the expense of patent litigation showed the unprofitable character of infringement suits. For years his advertisements have given notice to the profession that "Designing engineers will not be enjoined under the Luten Patents except when they oppose authorized Luten Designs for their own infringing plans." Mr. Luten does not attempt to monopolize the bridge business of the country or to collect royalty from that part of it that he cannot serve efficiently. All he asks is that he shall not be required to compete with unauthorized users of his patented inventions.

In one of his circulars published in 1914, he said: "A free license is granted on any infringing structure for which Luten Designs have not attempted to compete. This free license is for the benefit of innocent infringers only. It is not available when wilful and persistent opponents of Luten patents are interested in the letting." He has always asked public support upon the claim that bridge builders can pay his royalty and get a better bridge for less money. He has always urged that this test is best made after the bids have been submitted on competing plans.

Referring again to the opinion, the Judge says "Insofar as we can discover, none of the Luten patents has ever been sustained in a contested case, and they have been frequently held to be invalid for want of patentability." It is not true that none of the Luten patents had ever been sustained in a contested case. Three were held valid in the case of Luten vs. Mercantile Bridge Co., in Illinois, and two in the case of Luten vs. Rhoades and Kinsely, reported in 194 Fed. 169. These were contested cases as the records show. They were not contested with the thorough investigation of the record that characterized the Wilson case. But the same criticism obtains as to the cases in which the patents were held "invalid for want of patentability." With the exception of the case of Luten vs. Whittier, 251 Fed. 590, in which the Court of Appeals for the Sixth Circuit held five claims of patent 853,203 invalid, no court decided against the Luten patents after a consideration of any full and complete testimony as to the art.

The case of Luten vs. Boyer, Patterson and Morris was decided for the plaintiff after a contest, and the patents were held valid and infringed.

The opinion correctly states the cases in which the courts have decided against Mr. Luten, but the statement that the patents have been frequently held to be invalid for want of patentability is misleading. It is stating less than a half truth. Four patents only were involved in the Wilson case. Two of these four patents are in this case held invalid for the first time by any court; and of the other two this is the second time that they have been held invalid as to a few claims by a Circuit Court of Appeals.

The opinion in this case goes on to say that "Notwithstanding this experience these patents have been exploited by a skillful campaign of advertising in which it has been repeatedly asserted that no suit based on a Luten patent has ever been lost or dismissed." This statement was published, but when it was made it was true, and when it ceased to be true it was no longer published. In no form was the claim made when it was not wholly true. The charge of the court is unfair in that it conveys the belief that the claim was widely advertised at a time when it was untrue.

The opinion goes on to say that "the record in this case leaves no doubt that the entire scheme by which it has promoted those patents has been fraudulent." I can only say that the record that shows this is wholly incomplete, and presents a picture of the scheme of promotion that is not true. The court then details five methods of promotion and indicates that they are fraudulent.

The first quotes from a circular setting out the number of patents, of patent applications, the obtaining of decrees, and stating that no cases have been lost or dismissed. As said above, all this was true when the circular was sent out. Threats may be objectionable, but notice is not, and if the promise of suit is in general followed by suit, it is a notice and not a threat. It has not been the practice of Mr. Luten or of the National Bridge Co. to make idle threats. In fact one of the complaints made is that he brings too many suits.

The second method of promotion complained of is sending out in 1913 a list of "Luten Patent Decrees," giving the title of the case and the court in which they were rendered. This showing was sufficient to enable any one to inquire into the case. Not all of the decrees were by consent. Three were after contest, and some were taken by default. The need of the notice grew out of a number of very aggravated cases of infringement.

A third cause of criticism by the Judge is the use of an advertisement entitled "To Whom It May Concern." This

was used ten or eleven years ago. The advertisement lists the number, date and expiration of the first sixteen patents issued to Mr. Luten, and briefly defines the rights of a patentee, and the methods provided by law for the enforcement and protection of those rights, and concludes with the reported cost as actually given to Luten of the cases of Cameron Septic Tank Co. vs. Town of Saratoga Springs, aand Warren Bros. vs. City of Owosso. There is no charge that the advertisement is in any way false, and it correctly states the law of patent protection for the patentee.

The fourth specification of fraud by the judge is in these words: "Another showing is a collection in separate documents of all the consent decrees." A study of these decrees should convince any one of the fairness and honesty of the promotion of these patents by Mr. Luten. Fifteen of the decrees recite plainly in the first sentence that they were taken by consent of the parties, one recites the same thing in the last words of the decree; three show in the first sentence that they were rendered after a trial, and three state in the first sentence that they were taken pro confessor, i.e. by default. It is not conceivable how notice could be given of these decrees in any fairer or less deceptive way than by a copy of the decree approved and entered by the Clerk of the Court under the orders of the judge. Complaint of the use of a true copy of the decree is not fair and unbiased criticism. In patent litigation much weight is given to the opinion and decrees in other cases upon the same patents, and if decisions against the validity of the Luter patents are to be referred to as indicating invalidity and turpitude, certainly Mr. Luten may refer to the decisions in his favor as indicating validity and honesty. It has become the habit to sneer at consent decrees. Justices of the Supreme Court of the United States have not this habit. What consent decrees mean, and their value, was stated many years ago in a decision in a patent case in which Mr. Justice Nelson of the Supreme Court of the United States joined. The case of Porter vs. Fuller was one of a large number of cases involving the infringement of the Wilson patents on sewing machines. It was said:

> If, as Ingersoll, District Judge, states—and certainly we are bound to take his statements as correct—the suits were without collusion, were honestly defended, and finally the defendants only yielded to a judgment when it was evident that a contest would not be sustained. I think the evidence is quite as strong in favor of the propriety of these verdicts, and quite as much weight should be given to them, as if there had been a full trial and a jury had passed upon the facts; because it would indicate decidedly that the defendants and their counsel (and the papers show that they were eminent counsel—some of the first members of the bar), after a full examination of the facts in the cases, come to the conclusion that they could not be successfully defended, and, therefore, did not choose to risk a verdict of the jury upon them. It is stated as to those cases in Massachusetts, that there were no trials, but decrees were entered by consent, and so also in the cases before Justice Grier. There is no evidence in either of those cases that there was any collusion, and, in the absence of evidence, certainly the presumption is that there was none. These objections, therefore, to the force that should be given to the previous adjudications, we think cannot be sustained.

There was no collusion in any of the Luten decrees.

The fifth charge made by the judge in the Wilson case indicating fraud, and characterized as one of "a few of the more glaringly culpable of the representations," is, "Another advertisement sets forth that fifteen thousand designs for concrete bridges have been supplied under the Luten patents, and over six thousand of them have been actually erected." Mr. Luten admits that such advertisement was made, and also admits that it is true that he has done just what the advertisement says. If it is fraud and is glaringly culpable to make a commercial success of the inventions for which the United States government has issued him some forty-seven letters patent, the only honest and laudable field of invention is limited to devices such as perpetual motion and wet concrete.

The learned judge then refers with vivid irony to the brilliant campaign of promotion, the use of the arts of the advertiser and the photographer, and all these themes pressed with masterful skill "in that form of argumentation which is peculiar to the patent lawyer and the patent expert —a union of science and logic." If science and logic are to be avoided, what is left?

The charge against Mr. Luten is summed up thus: "We call attention to only two of the most reprehensible features of this campaign of deception by the use of half truths. First, the use of consent decrees throughout the entire literature without disclosing that they were by consent, and not the result of litigation. Second, the threat of patent litigation." The force of these two criticisms is destroyed by the intemperate words that follow: "This has been practiced with a studied use of menacing arts that would be blackmail on a vast scale if the threat had only been criminal instead of civil prosecution. In law this is a saving distinction, but not in ethics." With all deference to the opinion of the learned judge who wrote the opinion, Mr. Luten has never done anything that justifies any such charge. It is not admitted and is not decided that there is any moral turpitude involved in accepting consent decrees, when offered by the defendants, and he has not used threats of patent litigation in the sense that is unlawful or unethical. He has insisted on his rights under his patents, and when he found it necessary to do so has brought suits. Many times the charge has been made, and in the Eighth Circuit in particular, that no patent is of any value until it has been sustained by the courts. And now he is pilloried because he has sought to take the judgment of the courts as to their validity.

RUSSELL T. MACFALL,
Indianapolis, Ind. Attorney for O. B. Luten.

Study of Concrete Road Experience Urged

Sir—Is the monolithic, hard surface type of country highway paving, being so extensively constructed throughout the United States, justified by experience? This question is of grave importance at the present moment because of the extremely large mileage of this type being advocated and laid. It is of such importance that it warrants a careful study by, and comprehensive report from, the Bureau of Public Roads. The fact that state highway departments have adopted this type of paving as standard for country highways, without that information which might be made available through a comprehensive investigation such as that suggested above, makes the desirability of such a study all the more apparent. The fact that large sales organizations, offering the services of expert and well-paid engineers, are influencing the determination of the type of paving to be employed in numerous communities, is but another argument in favor of the governmental inquiry suggested.

It is a fact that, up to the present time, the only attempts to place an accumulation of data before state and county commissions have been made by these commercial agencies. Therefore, it is plain that a report prepared by governmental authority, placing at the disposal of the country at large a thoroughly impartial and uncommercial tabulation of actual information on this subject is vital to the future welfare of our good roads movement.

Although the Bureau of Public Roads is now engaged on extensive tests of various type roads as to impact, etc., and the report as to the results obtained will be of great value, I believe, nevertheless, that a report setting forth the experience so far obtained in the construction of cement concrete roads in this country would be of great value to all concerned.

Monolithic paving of the cement concrete type has been tried out in small amounts during a period extending back many years. Prior to about eight years ago, however, these experiments were carried on in isolated instances only. Since 1912 a large amount of this type of paving has been laid, and these eight years of experience should, at least, furnish sufficient data to permit a reasonable determination of the efficiency and economy of its use. A governmental inquiry, such as is suggested herein, should be entirely independent of the influence of local, state and county engineers, as well as engineers employed in advocating the various paving materials. Local results are liable to influence the judgment of those only locally responsible, whereas the question as a whole can only be determined by a nation-wide consideration of the subject.

The use of an easily replaced wearing surface on an

adequate foundation, as weighed against the maintenance and ultimate replacement of a monolithic type paving, gives the thinking engineer a serious problem and a tabulation of the actual facts deduced by the last eight years of experience might save many a costly mistake.

The writer believes that through some properly authorized engineering association or agency, this matter should be taken up with the proper governmental bureau or department.

FRED G. SIMMONS,
Consulting Engineer.
Milwaukee, Wis.

[A recent letter from the Bureau of Public Roads is to the effect that such a study has been contemplated for some time and that "it is expected within a very short time investigation will be undertaken with a view to securing definite information as to the comparative value of the different types of pavement now in general use."—EDITOR.]

A Plea for Bread—Through Road Construction Postponement

Sir—This letter might be called a plea for bread for the people. The farm labor shortage this year is serious and may later become alarming. Just after the armistice was signed a movement was set on foot (very rightly) for a large program of public works, especially road building, to provide against unemployment of the men from the army just being demobilized. Now the situation has changed greatly, there being no fear of unemployment but on the contrary a labor shortage and still the program of road work has not been greatly reduced but perhaps increased. Will not some highway departments voluntarily postpone (not abandon) a part of their program for this year and so make more labor available for the farms and for raising food? This has been done in New York State. Will not other states follow this good example and voluntarily reduce their labor requirements by letting some of the work wait till next year and perhaps also get the work done for less by so doing?

Mr. Ericson, formerly city engineer of Chicago, is advocating bringing in Chinese labor but those who know what the race problem is in the case of negroes have doubts.

JOHN WILKES.
Nashville, Tenn.

[Illinois and Minnesota as well as New York have heavily curtailed road construction.—EDITOR.]

Suggestions for Plank Surfacing of Secondary Highways

Sir—I read with considerable interest the article on p. 1052 in the *Engineering News-Record* of May 27, 1920, entitled "Plank Surfacing Suggested For Secondary Highways." Fortunately, we are not without experience as to how practical such a type of construction would be. A great many years ago "corduroy" roads were built in many sections of the country. Plank roads, too, of the type under discussion, although with not quite the elaborate methods of sub-drainage suggested, were constructed. A number of years ago in cutting through a road in western New York I discovered the remains of a plank road which had been covered under successive layers of gravel to a depth of about 3 ft. In the city of Charleston, W. Va., brick pavements were laid perhaps twenty years ago on such a plank surface used as a foundation course. Then too we have the action of plank bridge floors to guide us. During the construction of U. S. Government Explosives Plant "C" at Nitro, W. Va., temporary plank roads were laid as an absolutely necessary means of affording transportation through the mud in the early spring of 1918. These roads had no drainage provisions, however, and were badly worn under the heavy traffic in a few months.

A plank road might be justified in a pioneer country, or in times of great emergency, but could only be regarded as a temporary expedient. There would be no ultimate economy in such a type of construction. The article mentioned suggests a base course of broken stone 4 in. thick at a cost of $4,693 per mile, and estimates the plank surface at $7,792 per mile. Under these circumstances it would be much better economy to lay two courses of broken stone 4 in. thick at a total cost of $9,386, add a cold surface treatment of bituminous material at ½-gal. per sq.yd. which would perhaps cost $1,000, making a total cost of $10,386, compared with $12,485 for the suggested type of construction. My own experience leads me to believe that the suggested type of construction would not prove satisfactory under traffic for a great length of time and as shown above would not be economical.

H. J. SPELMAN, Division Engineer,
West Virginia State Roads Commission.
Huntington, W. Va.

Longest Suspension Bridge in New Zealand

Sir—I notice in your issue of Aug. 7, 1919, p. 263, that you refer to a suspension bridge constructed over the Manawatu River, near Palmerston North, as being the longest suspension bridge in New Zealand. As a matter of fact there is a suspension bridge in New Zealand over the Grey River, built in 1883, which has a central span of 660 ft.

F. W. FURKERT,
Asst. Engineer-in-Chief,
Public Works Department.
Wellington, N. Z.

Theory Shows Why the Pairs of Columns Are Not Equally Safe

Sir—An article by Edward Godfrey in your issue of May 13 presents a case of two pairs of columns and says: "Theoretically, then, the pairs of columns are identically stressed. Actually if they were made of a hypothetical metal, such as the theorist deals with, the nearest thing to which is glass, they would be equally dangerous." If they were equally unsafe, an increase in loading would produce the same effect on both, but this is not the case.

If the load on each column is increased from 100,000 to 120,000 lb., the moment in each column of the pair A is either decreased or remains the same, and the fiber stress is 24,000 lb. or less on the compression side. In the case of B, the moment increases with the load and the fiber stress becomes 26,400 lb. The pressure on the side of A would probably be relieved before the ultimate stress was reached so that this column would actually carry a great deal more than B before failure.

As a matter of fact, they are not identically stressed at any load, for in the case of A, the bending moment varies in a straight line from the ends to the center whereas in the case of B, the moment varies in proportion to the curve of deflection.

This would seem to explain "what becomes of the theory" and why "there is not an engineer living who will assert that the columns at A are as unsafe as those at B." It is doubtless a matter of common sense, as Mr. Godfrey says, but the sense is founded on nothing more than simple mechanics.

CHARLES C. HULBERT,
Consulting Engineer.
New York City.

[As the above reasoning shows, there may be a large difference between factors of safety computed respectively on the basis of stress and on the basis of load. This fact has been recognized before, but is commonly ignored in discussions of columns as well as of composite structures like bridges, where a somewhat similar line of reasoning applies. It is essential to effective discussion of column formulas, comparisons of safety of tension and compression members, and similar studies involving "factors of safety."—EDITOR.]

NEWS OF THE WEEK

New York, June 17, 1920

A $90,000,000 Water Project for Oakland District

California Cities Could Get 250,000,000 Gallons Daily from Eel River by 127-Mile Aqueduct

By C. E. HICKOK
Secretary, Engineering Committee, East Bay Water Commission and City Engineer, Alameda, Cal.

THE cities on the east side of San Francisco Bay will go 127 miles north to the Eel River for a water supply if the report of the East Bay Water Commission is carried out. This plan is considered a more feasible one than to join with San Francisco in the Hetch Hetchy project. Oakland, Berkeley, Alameda and Richmond, having a combined population of 370,000 people, joined in the investigation started in 1918 by establishing the commission named.

Due to the marked inadequacy of the present water supply of this district water has been lacking for domestic purposes and industrial development has been seriously deferred. During the summer of 1918 it was necessary to prohibit the sprinkling of lawns and gardens. The city council of each city appointed three members, consisting in each case of the city engineer, the city attorney and either a member of the city council or a private citizen to form an investigating committee.

Upon organization an engineering committee was formed consisting of all the engineers on the commission, to which was entrusted the direction of the engineering investigations. Similarly, a legal committee was formed of the lawyer members to consider the legal phases.

The engineering committee made exhaustive studies of the local sources of supply, including the existing system of the East Bay Water Co. and smaller companies. Studies were also made of the San Joaquin, Sacramento, Eel and McCloud Rivers as possible sources.

On Sept. 10, 1919, the commission, upon the recommendation of the engineering committee, appointed Philip E. Harroun, chief engineer, to be in charge of all further engineering investigations. Mr. Harroun's report was approved by the engineering committee and made public on April 28. Mr. Harroun concludes as follows: ". . . that the Eel River project is the project which should be selected for the supply of the East Bay Cities on account of the purity, quality and quantity of its waters, the cheapness of its construction, and the fact that it can be delivered into the cities probably within three years and certainly within four . . ."

(*Continued on p. 1224*)

Consulting Engineers Reaffirm Their Stand on Bridge Design by Architects

Action just taken by the council of the American Institute of Consulting Engineers on the Pittsburgh bridge case expresses complete agreement between that organization and the Board of Direction of the American Society of Civil Engineers. The Consulting Engineers reaffirm the principles of their resolution of Feb. 5, 1920, and express agreement with the resolutions of the Board of Direction. The new action was taken after the report of a joint committee of Engineering Council and the American Institute of Architects, noted May 27, p. 1079.

New York To Spend $4,000,000 for Snow-Removal Equipment

The Board of Estimate and Apportionment of New York City, on June 4, appropriated $4,127,000 for the purchase of motor-operated snow removal equipment by the Department of Street Cleaning. In urging the appropriation Mayor Hylan is quoted as saying: "I will not take the responsibility for any delay in this matter. We do not want the conditions of last winter repeated. If we put off action until the new budget is adopted the winter will be upon us and there won't be time to get the snow removal equipment."

Colorado River Flood Danger Said to Be Safely Passed

Press despatches from the Imperial Valley, California, state that the crest of the annual June flood in the Colorado River was passed on June 9 without serious damage having been done. A few days earlier there was a small break in the Ackerson levee, called the "first line of defense." This break washed out a few hundred feet of the levee that was being strengthened by dumping rock from a railway line on top of the levee. The rock was being added, it is said, because of a small break in the Ackerson levee in February, 1919.

More Water for Norfolk, Virginia

Lake Prince is advised as the source for a 15,000,000-gal. water-supply for Norfolk, Va., by Dabney H. Maury, consulting engineer, Chicago, in a report just made to the city authorities. A 36-in. supply main 100,700 ft. long would be required. For this cast-iron, wood stave and reinforced-concrete pipe, according to soil and hydraulic conditions, are recommended at estimated costs of $28.70, $12.16 and $15.25 a foot respectively. The total estimated cost of the project is $4,200,000.

Hopes Raised on Water-Power Bill

Attorney-General Rules Pocket Veto Does Not Hold But President Has Not Acted

For a time last week the hopes of the advocates of a Federal water-power bill were raised by some peculiar announcements from the White House. At this writing (June 16), however, there is no indication that the status of the bill is any different than was stated in these columns last week, which was that it was killed by the failure of the President to sign it before the adjournment of Congress.

The bill passed Congress May 29 and was sent to the President for his approval on June 1 or 2, the exact time not being known at present. On June 5 Congress adjourned without having received any notification from the President as to the bill. This situation has been known for years as a "pocket veto" and, with one possible exception has always been construed to kill the bill under the provision of the Constitution which reads "if any bill shall not be returned by the President within ten days (Sunday excepted) after it shall have been presented to him, the same shall be a law in like manner as if he had signed it, unless the Congress by their adjournment prevent its return; in which case it shall not be a law."

The matter seemed closed until June 10 when Secretary Tumulty announced that Attorney General Palmer had made an "informal ruling" that the President has ten days after the presentation of bills in which to sign them, whether Congress adjourns in the interval or not. No explanations of the ruling were given, though the presumption is that the interpretation hinges on the fact that the constitutional clause quoted refers only to a neglect to sign. It is stated, too, that in one instance President Lincoln approved a bill after Congress had adjourned and that although the Judiciary Committee of the House disapproved of the procedure, the bill stood as law.

At any rate gossip in Washington had it that the administration, goaded by the political capital being made at the Republican National Convention of the "pocket veto," was seeking some means of permitting the water-power bill to become law. If this is a fact, either the need for such a manœuver was later discounted or the means sought thought insufficient, for up to June 15 the President had not acted. Very obviously, if any action comes now the constitutionality of any bill so signed will be subject to court review.

Ask Consideration in New Rates on Construction Materials

The National Federation of Construction Industries has presented a petition to the Interstate Commerce Commission requesting a hearing, before a final schedule of railroad rates is adopted, to go into effect Sept. 1, 1920. The closing paragraph of the petition follows:

Your petitioner respectfully prays your Honorable Body, should the Commission decide to grant the applications of the Carriers to give them increases in revenues through increased freight rates, that before a schedule of increased freight rates is made effective, the Commission will arrange for the Federation and such of its constituent associations as may desire to be heard, to present to the Commission their data and arguments relative to the transportation costs to be placed upon their respective construction materials.

The Federation has also issued a circular letter to its membership requesting that members advise the general secretary, Drexel Building, Philadelphia, of any desire to participate in the hearing for which it has petitioned.

Hudson Bay Railway Work Confined to Maintenance

That work on the Hudson Bay Ry. this year will be confined to the repair of existing grades and maintenance and will not involve new construction was indicated in the reply made to delegates from the Western Provinces who went before the Ministers, April 22, to urge the completion of the line. It had been indicated previously in the report of the Minister of Railways and Canals, before Parliament, that the Government did not contemplate completing the line this year.

The committee from the Western Provinces stated that 332 miles of the road out of a total distance of 424 miles, from Le Pas to Hudson Bay, had been completed when work was suspended in 1918 and that, while $30,000,000 had been spent on construction, only $1,750,000 more was needed to complete the line.

The reply of the Ministers to the Western delegates left the impression that in addition to the repair and maintenance work promised, some additional track might be laid this year possibly as far as Limestone River. It was made clear that it was never the intention of the Government to abandon the work.

Progress on Alaska Railroad

The estimate of the Alaska Engineering Commission for the Alaska Railroad was cut but slightly by the Appropriations Committee. The Sundry Civil Bill carries $7,000,000 for work on the railroad during the next fiscal year. Colonel Frederick Mears, chairman and chief engineer of the Alaska Engineering Commission, told the Appropriations Committee that 100 miles of grading still remain to be done on the railroad. Of that amount 24 miles will be done during the coming summer. The grading is over the Alaska range and involves an $800,000 bridge over the Susitna River.

Council Asks Societies To Endorse Salary Classification

The Classification and Compensation Committee of Engineering Council, over the signatures of Arthur S. Tuttle, chairman, and Charles Whiting Baker, secretary, on June 9 addressed a letter to the secretaries of each of approximately 100 national or local engineering and other technical societies, asking formal endorsement by the governing body or by the society as a whole of the classification adopted by Engineering Council, to the end that it may become generally recognized and put into effect. As to the suitability of the scale compensation and the employment policy tentatively suggested, the committee desires an expression of views.

Through the medium of their society publications or some other convenient means, the secretaries are requested to urge the members to report to the committee any action taken to increase compensation or to adopt the standard classification. The committee proposes to act as a clearing house for receiving and giving out information to any group of engineers for use in discussing these matters with authorities who have the responsibility for fixing compensation. "Through co-operative action," the Committee states, "the effectiveness of the work done toward increasing compensation can be materially advanced."

To date several societies have taken action in regard to this matter. The Municipal Engineers of the City of New York on May 26, endorsed the classification and adopted a schedule providing for compensation at a rate approximately 20 per cent greater than that tentatively suggested by Engineering Council's committee. The classification has been closely followed by the Congressional Joint Commission on Reclassification of Salaries in its recommendations concerning engineers in the Federal service. It was approved on April 13, by the executive committee of the American Society for Testing Materials. The Boston Society of Civil Engineers made the endorsement of the tentative schedule of compensation the subject of a letter ballot by the full membership, which is now being canvassed. It is hoped to bring about a recognition of Engineering Council's classification as standard.

The committee has been reorganized and is now made up as follows: Arthur S. Tuttle, Chairman, deputy chief engineer, Board of Estimate and Apportionment, New York; Charles Whiting Baker, secretary, consulting engineer, New York; Frederick W. Cappelen, city engineer, City Hall, Minneapolis, Minn.; Philip P. Farley, consulting engineer, Brooklyn; O. C. Merrill, chief engineer; Forest Service, Washington D. C.; C. A. Morse, chief engineer, C. R. I. & P. R.R., Chicago, Ill.; M. M. O'Shaugnessy, city engineer, City Hall, San Francisco, Cal.; R. S. Parsons, general manager, Erie R.R., New York; and Edmund I. Mitchell, assistant secretary, New York.

New Charter for Montreal Proposed

In a preliminary canvass the Charter Commission of Montreal has found that most of its members favor having the proposed new charter provide for a city manager, a council of 9 to 15 members chosen by proportional representation instead of by wards, the referendum and the recall.

$90,000,000 Water District for Oakland

(*Continued from p. 1223*)

The Eel River project will consist of a storage dam, a diversion dam and an aqueduct 127 miles long. The aqueduct will consist of 30 miles of tunnels, 6 miles of concrete conduit and 91 miles of steel and concrete pipe, including a tunnel crossing under the Sarquinez Straits 2 miles long and 600 ft. below the water surface.

The safe net yield of the Eel River project is estimated at 250,000,000 gal. daily. The estimated cost, if developed in three stages, is $90,479,000 or $362,000 per 1,000,000 gal. daily. With credit for power development along the aqueduct the cost would be $82,229,000 or $329,000 per 1,000,000 gal. daily. If the project were developed at once to its full safe yield of 250,000,000 gal. daily the total cost would be decreased by approximately $24,000,000.

The proponents of the Hetch Hetchy project now under construction by the City of San Francisco for the development of the waters of the Tuolumne River have contended that the East Bay cities should join with San Francisco in that project. However, the report of Mr. Harroun shows that the expense of the East Bay cities for their share of the cost of the Hetch Hetchy project would be $56,718,000 more than the cost of the Eel River project.

The estimated cost of the Hetch Hetchy project to Irvington gate house, from which point diversions would be made to the East Bay district and the city of San Francisco, respectively, is $169,083,000. It is estimated that the East Bay district would be charged with 60 per cent of this cost and in addition would have to pay for the cost of a conduit from Irvington gate house to Lake Chabot in Oakland, making a total cost of $123,457,000.

The East Bay Water Commission expects to present in June its recommendation as to the proper procedure for the formation of a water district, embracing the cities and territory concerned.

Charles E. Hewes, city manager, Alameda, is chairman of the commission. Engineers on the commission are Marston Campbell, formerly city engineer, Oakland; H. D. McGlashan, district engineer, U. S. Geological Survey, Oakland; Lewis A. Hicks, consulting engineer, Berkeley; H. D. Chapman, city engineer, Richmond, and the writer.

General W. M. Black Heads New Engineering Firm

Maj. Gen. William Murray Black, Corps of Engineers, U. S. A., retired, who was Chief of Engineers of the United States Army during the war, has formed a partnership with Col. C. A. McKenney and Lieut. Col. John Stewart for the general practice of consulting, organization, and administrative engineering, giving special attention to river and harbor, port and terminal work, hydro-electric development, and municipal and highway engineering. The offices of the new firm, which is called Black, McKenney & Stewart, are at 618 17th St., N. W., Washington, D. C.

General Black graduated from West Point in 1877 and rose through the Corps of Engineers to the position of Chief, which he took March 7, 1916, retiring Oct. 31, 1919. He is the author of "Public Works of the United States" and many treatises dealing with the civil and military work of the Corps of Engineers. His assignments in the Corps, in addition to the usual river and harbor details, were of a much more civilian character than many officers of the Corps get. First, he was engineer-commissioner of the District of Columbia in 1897-98, and just after the Spanish War, from 1899-1901, he was chief engineer first of the Department of Havana, and second of the Department of Cuba. During this period he had extensive sanitary work to do in Havana, and he also organized the Department of Public Works at Cuba.

Colonel McKenney graduated from Princeton and spent a large part of his professional life in the Engineering Department of the District of Columbia. At the outbreak of the war he was assigned as an assistant to the Chief of Engineers, in which capacity he was charged with the co-ordination of the Engineer Corps Supply operations with the supply operations of other branches of the government and the civilian population. He became later a colonel of Engineers and was detailed to the General Staff as War Department representative on the Priorities Division of the War Industries Board.

Colonel Stewart has been connected with the Cranford Paving Co., general contractors of Washington, D. C., first as office assistant and finally as assistant to the president. In 1910 he became president and chief engineer of the Cranford Construction Co. He entered the war as captain of Engineers, and became lieutenant colonel in August, 1918. His main duty was in connection with transportation, coal supply, etc., incident to the war operations. He was also executive officer and engineer of the Committee of Inland Waterways of the United States Railroad Administration.

General Black has recently resigned as consulting engineer of the Port and Harbor Facilities Committee of the United States Shipping Board.

Cleveland Water-Works Enlargement Recommended by Engineers

Doubling the present capacity of the water-works of Cleveland, Ohio, so it would serve 1,900,000 population in 1940, is recommended in a report of an engineering commission appointed last November consisting of J. W. Frazier, James H. Herron and City Engineer Robert Hoffman. The enlarged works would be sufficient for all Cuyahoga County and would cost some $30,000,000, which it is proposed to secure from water-works revenue provided by increasing the rates from 40 to 60c. per 1,000 cu.ft. Some of the enlargements advised are more pumps, a new east side tunnel by 1930 and a new west side tunnel by 1937, new filtration plants and a high service reservoir. Thomas S. Farrell is director of public utilities and John T. Martin is commissioner of water. An investigation of the water-supply needs of Cleveland was begun in 1917 by A. V. Ruggles.

Reconstruction Committee Named by Construction Industries

In accordance with recently announced plans to assist the newly created Senate Special Committee on Reconstruction and Production, the National Federation of Construction Industries has appointed a similar committee to co-operate with the Senate Committee. Its personnel is: B. F. Affleck, Chicago, Ill., Universal Portland Cement Co.; Philip H. Gadsden, Philadelphia, Pa., vice-president United Gas Improvement Co.; John L. Kaul, Birmingham, Ala., Kaul Lumber Co.; Charles F. Lang, Cleveland, Ohio, president Lakewood Engineering Co.; Gen. R. C. Marshall, Jr., Washington, D. C., chief Construction Division, U. S. A.; W. T. Rossiter, Cleveland, Ohio, vice-president Cleveland Builders' Supply Co.; J. Willison Smith, Philadelphia, Pa., vice-president Land Title and Trust Co.; and Robert C. Wright, Philadelphia, Pa., general traffic manager Pennsylvania R.R. Co.

New Jersey Highway Commission Favors Truck Regulation

The New Jersey State Highway Commission has gone on record as favoring the regulation of the size and weight of motor trucks in New Jersey, and an increase in the annual registration fee. A resolution covering these points was adopted at a recent meeting of the commission and copies have been forwarded to Governor Edwards, the members of the State Legislature and the members of the Boards of Freeholders throughout the state. The resolution points out that changes are necessary in order to maintain the improved highways of the state. It is said that the present license rates are noticeably low compared to those existing in other states. The increase in fee is urged in order to meet the damage done to the highways by the heavy trucks each year.

Engineers Direct Relief to New York Freight Tie-Up

An organization to operate independent motor trucks to relieve the freight situation in New York City is being directed by engineers, headed by Colonel F. A. Molitor, Colonel Charles B. Hine, and Major J. P. Hallihan. Colonel Molitor, who during his service with the A. E. F. in France, was detailed to reorganize the system of handling supplies at the various storage depots in the S. O. S., is in charge of operations for the Citizens' Transportation Committee, formed by the Merchants Association of New York City to break the tie-up of freight which has resulted from the long drawn-out strike of longshoremen.

A corporation known as the Citizens Trucking Co., with a capital of $100,000, has been organized by the Transportation Committee and is equipped with about 80 motor trucks and garage and warehouse facilities for the handling of freight from terminals affected by the strike, which is not confined to the coastwise steamship lines.

The operation of the independent trucks, under the direction of Colonel Molitor, began last week when loads were handled from the coastwise steamship piers in trucks operated by ex-service men of the 165th Infantry or the old 69th Regiment of New York. This week between 50 and 70 trucks are in operation, and are practically all of 5-ton capacity. Freight which has been collected on the piers has been sorted so that trucks can carry full loads, making three or four trips per day under a centralized system of dispatching, which in some cases has resulted in return loads being handled.

The present phase of the longshoremen's strike extends to the piers of the coastwise steamship lines including the Morgan Line of the Southern Pacific Co., the Clyde Line, the Mallory Line, and the Ocean Steamship Co. Union truckmen had refused to handle freight on these piers which had been loaded by non-union longshoremen. After repeated efforts to end the strike had failed, there were still 3,000 tons of coastwise freight held on the piers, most of which was of such essential character that serious consequences were threatened to the business and life of New York City.

Some difficulty has been experienced in persuading other carriers and warehouse corporations to accept goods handled by the independent trucks, but a decision was handed down last week by Justice Lewis L. Fawcett, New York Supreme Court, ruling it to be a violation of the United States Shipping Act and a crime to refuse to transport merchandise in the furtherance of an illegal combination and restraint of trade. It is now thought that carriers and warehouses which heretofore have refused to accept freight moved by independent trucks will now be compelled to do so by injunction under Judge Fawcett's decision.

Winnipeg Entertains 200 Delegates at Good Roads Congress

Approximately 200 delegates from all parts of Canada and from many parts of the United States, and representative of the technical and business sides road construction, attended the seventh annual Good Roads Congress held in Winnipeg, June 1-3. Co-operation among the various educational, technical, governmental and civic bodies for building connected systems of highways and co-ordination among all bodies charged with road construction and maintenance were keynotes of many of the speeches and papers delivered and read before the congress.

President S. L. Squire, in his address, summed up the economic importance of stated that, inasmuch as there were serviceable highway systems when he 350,000 mi. of highways in Canada as compared with 37,000 mi. of railroads, and inasmuch as the value of the rolling stock using highways was not less than the cntire capital stock of all railways, federal and provincial governments could now be convinced that money expended on improving roads was no longer a grant but an investment.

Not only were the technical features of road construction dwelt upon in the various papers read, but the broader aspects received full consideration. Of chief appeal at the present time where those papers relating to the necessity for co-operation between the highway departments and colleges for training a competent and large enough body of highway engineers to handle the administration of highway funds and as well direct construction of the vast mileages included in present day road programs; and those in which emphasis was placed upon most careful maintenance as the only means through which existing mileage could be saved until costs of materials and labor allow greater activity in construction of so called durable types.

At the closing session resolutions were adopted: Favoring the linking of the provincial highway systems by a trunk road; urging upon the local good roads associations the need of co-operation through a central association; endorsing the grant of federal aid for road construction; and asking for a grant to assist the association's work. A resolution urging co-operative action between the federal and provincial governments for the early planning of a national highway, was referred to a committee for further consideration.

The following officers were elected: President, A. E. Foreman, chief engineer of the Public Works Department, British Columbia; first vice president, Dr. E. M. Desaulniers, Montreal; second vice president, Hon. S. J. Latta, Minister of Highways, Saskatchewan; secretary-treasurer, George A. Mc Namee, Montreal; members of the advisory committee, U. H. Dandurand, Montreal; W. A. McLean, Deputy Minister of Highways, Ontario; B. Michaud, Deputy Minister of Highways, Quebec; J. A. Duchastel, city engineer and manager, Outremont, Quebec; S. L. Squire, past president, and A. F. Macallum, past vice president.

No Public Works Department Possible This Year

Congress adjourned May 31 without passing any bill for a Public Works Department or in fact for any investigation or revision of government activities. The National Public Works Department Association, however, states that the so-called reorganization of Federal departments plank in the Republican platform is due to the efforts of those who have been backing the Public Works Department idea. This plank reads as follows:

"We advocate a thorough investigation of the present organization of the Federal departments and bureaus, with a view to securing consolidation, a more businesslike distribution of functions, the elimination of duplication, delays and overlapping of work and the establishment of an up-to-date and efficient administrative organization."

The Smoot-Reavis resolution also failed to be enacted. This resolution provided for the appointment of a Congressional committee to make studies looking to the reorganization of the administrative branch of the government. It was brought up in the closing hours of Congress and the vote was 141 for and 131 against. Under a suspension of the rules, a two-thirds vote was required and therefore the resolution was lost. The vote was along strict party lines, the Republicans approving the idea and the Democrats being against it. The opposition of the Democrats was not to the reorganization of the executive department in the necessity of which they apparently concurred, but to the manner in which it was to be done. They desire that the organization be carried out under the newly created director of the budget and the Republicans desire that it be done through a joint committee of the Senate and the House.

Examination for Commissions in Engineer Corps Announced

In view of the passage of the Army Reorganiation Bill, creating a number of vacancies in the commissioned personnel of the regular army, the War Department has announced that examinations will be held throughout the United States beginning July 7. Applications for this examination close June 23. Exemptions will be granted from examination, it is stated, to those candidates who can convince the examining board that they have the required degree of education for appointment. For commissions in the Corps of Engineers examinations will be held at Boston, New York, Charleston, S. C., Chicago, Fort Sam Houston, Tex., and San Francisco.

$12,000,000 Rivers and Harbors Bill Was Passed

Congress just before adjournment agreed on a Rivers and Harbors Bill carrying a $12,000,000 appropriation and the bill was signed by the President. The Senate agreed to forego its bill which called for nearly twice the amount in the bill as passed.

Duquesne Voters Kill Bond Issue

The voters of the Borough of Duquesne, Pa., refused to sanction a proposed bond issue of $745,000 for street improvements and the reconstruction of Thomson Run bridge. They believe that the work can be delayed until better prices prevail.

Provisions of Merchant Marine Act Suspended by Shipping Board

Two sections of the new merchant marine act have been suspended temporarily by the United States Shipping Board. The first prevents the granting of export and import rates lower than the domestic rail rates on commodities carried in foreign vessels, and provides that such preferential rates shall be given only on goods carried in American vessels (Section 28). The Board claims that a great volume of shipments has already been booked under existing tariffs and that the enforcement of this section at once would cause disturbance of commerce. It has therefore asked the Interstate Commerce Commission to suspend this provision of the law for ninety days. Under another requirement of the new act, a vessel is forfeited in the event of charter to aliens other than under regulations prescribed by the Board (Section 18). On June 9 the Board passed a resolution providing that vessels documented under the laws of the United States may be chartered to aliens for periods not exceeding three months or for a voyage the probable duration of which will not exceed three months. By this resolution, therefore, the Board has in effect suspended Section 18. It is announced that specific regulations covering voyage and time charters will be issued by the Board later.

United States May Join International Road Congress

As a result of the recent two-day meeting at the office of the Bureau of Public Roads, Washington, D. C., the executive committee of the American Association of State Highway Officials recommended the acceptance by the United States of the invitation of foreign countries to become a member of the Permanent International Association of Road Congresses. The committee also recommended that the International Association be invited to the United States for its next meeting. Invitation to join the Association was received by the State Department from the American Consul-General in Paris. Secretary of Agriculture Meredith con-

curred in the recommendation of the executive committee and asserted that he would recommend to the State Department that Congress be asked to authorize acceptance of the invitation.

Thomas H. MacDonald, chief of the Bureau of Public Roads, strongly advises the United States to become a member of the International Road Congress, inasmuch as it is the only civilized country not now a member and also inasmuch as good would come of joining an organization which constitutes an international tribunal for bringing together the best experience and results in highway construction and administration.

Civil Service Examinations
United States

Highway bridge engineer, $2,100 to $2,700 a year. Form 1312. File application not later than July 13.

Junior highway bridge engineer, $1,320 to $1,920 a year. Form 1312. File application not later than July 13.

Safety engineer, $2,500 to $3,000 a year. Form 1312. File application not later than June 22.

Superintendent of Motor Transportation, $2,100 to $2,400 a year. Form 1312. File application not later than June 22.

Engineer in forest products, $2,160 to $3,600 a year. Form 2118. File application not later than June 22.

Assistant engineer in forest products, $1,500 to $2,100 a year. Form 2118. File application not later than June 22.

Research engineer, $3,000 to $3,600. Form 2118. File application not later than July 20.

Assistant civil engineer, U. S. Navy, $3,200 to $9,600 a year. File application with Bureau of Yards and Docks not later than Aug. 1.

ENGINEERING SOCIETIES

Calendar
Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Portland, Ore., Aug. 10-12.

AMERICAN WATER WORKS ASSOCIATION, New York City; Montreal, June 21-26.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; Asbury Park, N. J., June 22-25.

AMERICAN PUBLIC HEALTH ASSOCIATION, Boston; San Francisco, Sept. 13-17.

The Oklahoma Members, Am. Soc. C. E., in connection with the recent meeting of the Oklahoma Society of Engineers, held at Muskogee, perfected a state organization, with officers as follows: President, H. V. Hinckley, consulting engineer, Oklahoma City; vice-presidents, E. S. Alderman, Federal Road Engineer, Oklahoma City; C. M. Pritchard, consulting engineer, Tulsa; E. M. Graham, consulting engineer, Muskogee; F. D. Brown, city engineer, Shawnee; H. F. Layton, Empire Gas Co., Bartlesville; Max L. Cunningham, Municipal Construction Co., Oklahoma City; secretary, F. H. Craddock, Musson & Gayle, Oklahoma City.

The San Francisco Section, Am. Soc. C. E., held a meeting, June 8, to discuss the general topic "Causes of and Problems Attendant Upon Increased Salinity in San Pablo and Suisun Bays." A. A. Brown, chief engineer of the California and Hawaiian Sugar Co., read an illustrated paper on "Teredo Attacks on Piles that Have Been Immune for 50 Years." A paper by T. H. Means, consulting engineer, on "What Increased Salinity Means to Irrigation and Potable Water Systems" was also presented. More than one hundred members and guests attended, and many phases of the problem under consideration were brought out in the general discussion that followed the papers. To make sure that the discussion would be comprehensive, the two main papers were made brief and arrangement was made in advance with six members to come prepared to make four-minute discussions. It was announced at the meeting that 40 members of the section (the maximum number that could be taken) had purchased tickets for the four-day inspection trip over the Hetch Hetchy project scheduled for June 12-15.

The Iowa Section Am. Soc. C. E. was addressed at Ames, June 8, by President A P. Davis, on "The Duties of the Engineer Outside of His Strictly Technical Activities." Mr. Davis was at the Iowa State College attending the semi-centennial celebration, at which time he received the honorary degree of doctor of engineers.

PERSONAL NOTES

JAMES W. COSTELLO, engineering supervisor, Bureau of Street Cleaning and Refuse Collection, Newark, N. J., has been appointed head of the newly created Division of Streets. This Division will include three old bureaus: (1) street cleaning and refuse collection; (2) streets, formerly in charge of paving, repaving, maintenance of all highways and supervision of the municipal asphalt plant; (3) street regulation, which had charge of street obstruction, sidewalk repairs, street signs, and permits for street openings.

T. P. JOHNSTON, research engineer, Southern Pine Association, has resigned to enter the engineering department of the Pennsylvania R.R., with headquarters at Philadelphia and Baltimore. Mr. Johnston was previously in the engineering department of the Union Pacific.

W. E. BLOMGREN, division engineer, Frannie division, Shoshone (Wyo.) Project, United States Reclamation Service, has resigned to become assistant engineer for A. J. Wiley, consulting hydraulic engineer, Boise, Idaho.

T. O. RUSSELL, formerly chief engineer, Alsea River Lumber Co., Glenbrook, Ore., and later consulting engineer for that company, has been retained by the Miami Corporation as consulting engineer on the development of its tract of 30,000 acres of timber in western Oregon, near Willamina.

KARL R. KENNISON, formerly plant engineer, Emergency Fleet Corporation, in charge of shipyard and dry-dock construction at New Orleans, Mobile, and Pensacola, has opened offices for private practice at 18 Tremont St., Boston.

JOHN N. MACKALL, for the past two years chief engineer, State Roads Commission of Maryland, has been appointed by the Governor as chairman and chief engineer of that body, succeeding Frank H. Zouck, the former chairman, who has resigned. Mr. Mackall has been connected with the State Roads Commission in engineering work for the past sixteen years, except between 1916 and 1918, when he was office engineer, Pennsylvania State Highway Department.

CHARLES D. EVANS and E. W. BUXTON have become associated in partnership, under the firm name of Evans & Buxton, for the practice of engineering, with offices in the Simon Building, Shreveport, La.

J. C. MEACHEM, formerly assistant engineer of Brooke County, W. Va., has been appointed district road engineer, Marshall County W. Va.

JACOB L. CRANE JR., of Gannett, Seelye & Fleming, engineers, Harrisburg, Pa., sailed from New York, June 9, for Venezuela and Colombia, to take up several private engineering projects.

SIDNEY A. DEAN and WILLIAM A. DOERRIES have formed the Ozark Engineering Co., Springdale, Ark., to engage in the general practice of engineering, specializing in highway and municipal work.

WILLIAM G. THOMPSON has resigned as state highway engineer of New Jersey to engage in engineering work with private interests in New York City.

HENRY B. ALVORD, formerly assistant professor of civil engineering at Bowdoin College, has been appointed assistant professor of railway engineering at Northeastern College, Boston.

DR. VAN. H. MANNING has resigned as director of the U. S. Bureau of Mines and has accepted the position of director of research with the recently organized American Petroleum Institute.

E. S. DRAPER has been appointed principal assistant engineer, Boston & Albany R.R., succeeding L. G. Murphy, resigned.

E. H. MCMILLIN has resigned as

road engineer of Gilmer County, W. Va.

W. E. PUTNAM, since 1916 with Ford, Bacon & Davis, New York, engaged in valuation work, has returned to Birmingham, Ala., to be associated with Robert L. Totten, consulting engineer.

F. M. VEATCH, who recently resigned as sanitary engineer of the Nebraska State Board of Health, is now chief engineer of the Henningson Engineering Co., Omaha.

JAMES H. JOHNSTON has been appointed superintendent of highways of Providence, R. I. He suceeds the late Ralph A. Vickere.

WATSON H. CLARK, formerly of the New Jersey State Highway Commission, has been appointed consulting engineer to the Highway Department of New Jersey, pending the appointment of a successor to William G. Thompson, who has resigned as state highway engineer, as noted elsewhere.

JULIAN MONTGOMERY has resigned as county engineer, Rockwall County, Tex., to become city engineer of Wichita Falls, Tex.

JOHN A. FOCHT, assistant engineer of Rockwall County, Tex., has been appointed county engineer, succeeding Julian Montgomery, resigned as noted elsewhere.

W. W. K. SPARROW, chief engineer of the Chicago, Milwaukee & St. Paul Ry., has been appointed assistant to the president of that road, succeeding H. M. Sloan, resigned. He will be in charge of valuation, adjustment of Federal accounts and other assigned duties, with office in Chicago. During Federal control he was corporate chief engineer of the road.

GEORGE K. ARMES has resigned as assistant engineer and office engineer of the Florida State Road Department, and will open an office in Tallahassee as a consulting and highway engineer.

GEORGE M. WISNER, for 13 years chief engineer of the Sanitary District of Chicago, has resigned to go into private practice, although he is retained as consulting engineer to the district. Edward J. Kelly, assistant chief engineer, will succeed Mr. Wisner.

C. I. ANDERSON has recently been appointed engineer of bridges, Illinois Central R.R.

GEORGE GARRETT, recently city engineer, has ben appointed city manager of La Grande, Ore.

F. A. JONES has been appointed office manager of the Boston & Albany R.R.

A. H. KROM, assistant secretary of the American Association of Engineers has resigned to enter business. Mr. Krom was one of the organizers of the association and is member number 1.

LIEUT.-COL. CHARLES W. KUTZ, engineer commissioner of the District of Columbia, has been promoted to the rank of colonel. Colonel Kutz is chairman of the commission in charge of zoning the City of Washington.

HARRY F. FERGUSON, recently senior assistant engineer, has been appointed acting chief sanitary engineer of the division of sanitation and engineering of the Illinois State Department of Public Health. He succeeds Paul Hansen, recently resigned.

OBITUARY

BEVERLY R. VALUE, president of the General Contractors' Association of New York, died in New York City, June 10. He was born in Montgomery, Ala., in 1863 and was graduated from the School of Mines, Columbia College, in 1884. The next year he became a member of the engineering staff of the New York Aqueduct Commission. In 1886 he was appointed assistant engineer in charge of the construction of Section 6 of the new Croton aqueduct, and following its completion, in 1900, was engaged for a year on final estimate work and the preparation of records for court action. From 1893 to 1900, he was in charge of construction of the new Croton dam, under Charles S. Gowen, division engineer. From 1900 to 1903 he was division engineer for the New York City Rapid Transit Commission on subway construction. The next five years he spent as chief engineer of the Electrical Development Co. during the construction of the hydro-electric plant at Niagara Falls, and as engineer of the McCalls Ferry Power Co. on the construction of a similar plant on the Susquehanna River. During the last 12 years Mr. Value has been associated as chief engineer, comptroller and director of H. S. Kerbaugh, Inc., the Empire Engineering Corporation, and the Kerbaugh-Empire Co. and as secretary, treasurer and director of George W. Rogers & Co. He was a member of the American Society of Civil Engineers and the Engineers' Club. Mr. Value was born in Montgomery, Ala., in 1863.

ALBERT CHATIGNY, civil engineer, of Montreal, died in that city June 3. He was for many years in the Federal Public Works Department, during which period he was one of the engineers selected to take charge of the construction of the channel between Montreal and Quebec. Mr. Chatigny was a graduate of the Ecole Polytechnique of Montreal. He was 43 years of age. He contracted tuberculosis in a training camp during the war.

ARNOLD E. BROENNIMANN, civil engineer, died May 29, at Watertown, Wis., in which town he was born in 1876. He graduated from the University of Wisconsin in 1897 and afterward engaged in deep waterway work for the Government, eventually becoming a member of the survey staff of the New York State Deep Waterway Commission.

BUSINESS NOTES

SIDNEY S. FRIEDMAN and JOSEPH D. KARASIK have incorporated as Karasik, Friedman & Co., with offices in the Woolworth Building, New York as dealers in iron and steel and new and relaying rails.

THE POWER PLANT SUPPLY CO. has been organized, with offices at 707 Canal Road, Cleveland, to deal in pumping machinery and power plant equipment. William E. Berrington is secretary and manager of sales.

THE MILLIKEN BROTHERS MFG. CO., INC., New York, manufacturers of all-steel, one-story industrial buildings, have established branch offices at Chicago, Cleveland, Atlanta, Ga., Chattanooga, Tenn., New Orleans, Dallas, Tex., Houston, Tex., and Tulsa, Okla. Representatives have also been appointed in London, Melbourne, Australia, and Havana, Cuba.

THE CALIFORNIA ENGINEERING CO. announces the openings of offices at 131 Leidesdorff St., San Francisco, for investigating and reporting on problems in the fields of civil, mechanical, electrical, hydraulic and marine engineering; also the organization, development and management of engineering projects. Paul B. McKee is president of the company and Paul R. Parker is vice-president and chief engineer. Three associate engineers are named as follows: P. O. Crawford, W. M. Shepard and C. E. Blee.

THE W. D. SULLIVAN & SONS CO., contractors and engineers, has been organized with headquarters at Columbus, Ohio. The new company has specially organized departments for highway, railroad, and bridge construction, industrial plants, sewer construction, excavation, and designing and engineering. The officers of the company are: President, W. D. Sullivan; first vice-president, Charles B. Pray; second vice-president, H. M. Ogden; secretary-treasurer and general manager, H. E. Sullivan. The department managers are: W. D. Sullivan, H. M. Ogden, C. B. Pray, G. R. Ensminger, J. F. Brown, C. C. Schulmann, and W. H. Butterworth.

THE WELLMAN-SEAVER-MORGAN CO., Cleveland, announces the election to its board of directors of John A. Penton, president of the Penton Publishing Co., to fill the vacancy on the board caused by the death of Samuel T. Wellman.

THE GEORGE F. WATTS CORPORATION, engineers and contractors, steel construction, of Boston, Mass., announce the opening of a permanent New York City branch office at 30 Church St., with Walter F. Barker as New York district manager and Henry Porlier as chief engineer.